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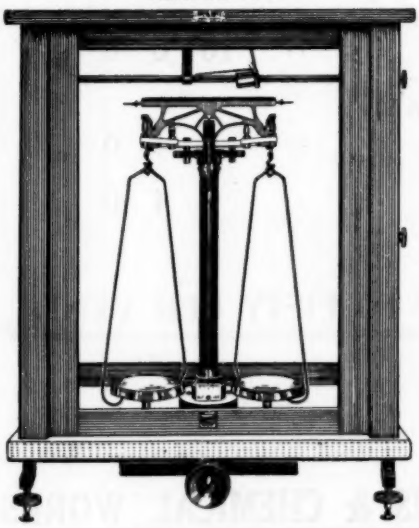

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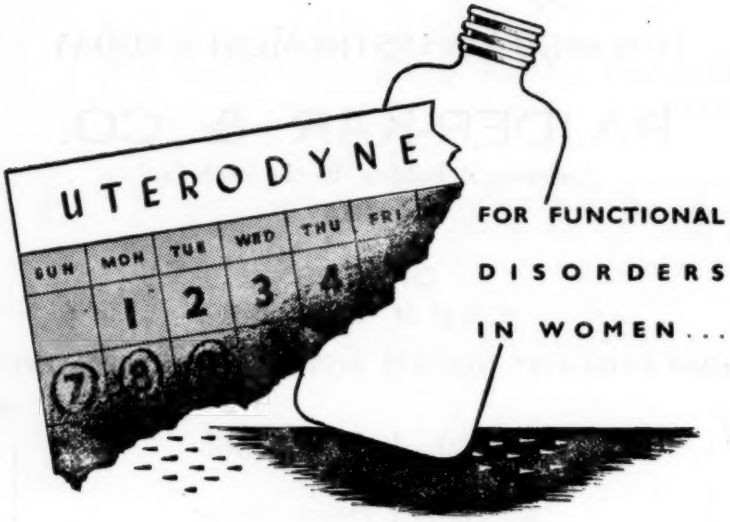

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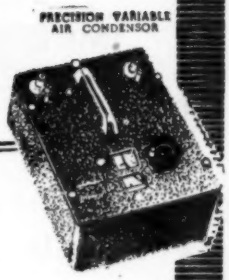

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Four copies of the application in the prescribed form, duly forwarded by the Head of the Laboratory at which research is proposed to be undertaken, should reach the Secretary, National Institute of Sciences of India, University Buildings, Delhi, before the 15th June, 1948. The application should be accompanied by testimonials from two persons who can testify to the candidate's ability for the proposed research and reprints of any papers the candidate has published. For copies of the form of application, a large self-addressed envelope should be enclosed.

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CENTRAL LEATHER RESEARCH INSTITUTE*

THE idea of having this Institute at Madras was conceived as far back as in 1945, but for various reasons beyond our control it could not take a concrete shape earlier. In recognition of the great importance of leather industry in this country and with a view to furthering the study of and research in leather technology the Council of Scientific and Industrial Research has been making a block grant of Rs. 60,000 a year to the University of Madras, so that they could run a centre of leather research and technology in the University, which may ultimately develop into a full-fledged Research Association Laboratory. In a national endeavour of this nature, it is through the willing co-operation of one and all that success could be achieved. In our effort to establish this Institute, we have had the sympathy and support of the National Government at the Centre, the Government of Madras, the commercial community of India interested in leather trade and industry and the University of Madras. I wish to take this opportunity for thanking Shri C. Rajagopalachari, Shri T. Prakasam, Shri O. P. Ramaswamy Reddiar and Sir A. Lakshmanaswamy Mudaliar, for the invaluable help they have given us. The Government of Madras have promised to place at our disposal free of cost a site measuring about 200 acres and also to bear a part of the recurring expenditure of the proposed Institute. The industry has also promised to make contributions towards capital as well as recurring expenditure but the brunt of the burden will be borne by the Central Government through the Council of Scientific and Industrial Research.

The leather industry plays an important role in India's national economy. India has the largest herds of cattle in the world—about 180,000,000 cows and oxen, 50,000,000 buffaloes, 46,000,000 sheep, 58,000,000 goats and 12,000,000 of other kinds; and her estimated leather production which include 20 million cow hides, 5·7 million buffalo hides, 27·5 million goat skins and 17 million sheep skins, ranks the highest. The Indian Hides Cess Committee has valued the nation's normal production of raw leather at about 19 crore rupees with a present value, about twice this. Hides and skins, raw as well as tanned, form a big item in

* Extracts from a speech delivered at Madras by Sir Shanti Swarup Bhatnagar, Director, Scientific and Industrial Research, while requesting the Hon'ble Dr. Shyama Prasad Mookerji to lay the foundation-stone for the building of the Central Leather Research Institute on April 24, 1948.

India's export trade. As a result of partition approximately one-sixth of the bovine population and one-eighth of the goats and sheep are included in Pakistan area. The production of hides and skins will also be reduced roughly in the same ratio.

The province of Madras occupies a singular position in India's leather industry. Twenty per cent. of the cows, 25 per cent. of the buffaloes, 25 per cent. of the goats and more than half the total number of sheep in the whole of India are reckoned to be in this province. Madras is also rich in vegetable tanning materials such as *Tarwar* or *Avaram, Amalatas, Babul myrobolans, Mangroves, Divi divi,* etc. Recently wattle cultivation has also been introduced with good success, though it is not yet sufficient to meet the demand. The skill of the Madras tanner is world renowned, and the preparation of half-tanned hides is a unique speciality of his province. Ninety-five per cent. of hides and 85 per cent. of skins exported from India are sent out from Madras.

Need for a Leather Research Institute in India

The Indian leather industry is still characterised by the two chief attributes of its past great tradition: (1) it has essentially remained a decentralised cottage industry in spite of the few big organised tanneries, and (2) it has continued to be a craft based more on empirical knowledge than on modern scientific methods.

We live in an age of science, and the modern leather industry owes a great deal to science; scientific methods are being applied to it to an ever-increasing extent effecting continual progress in the techniques of production. To develop and maintain the Indian leather industry in the forefront of progress demands, in the face of world-wide competition, ready access to new discoveries in science which are the raw material of all new development. This being so, a national research effort adequate to produce these basic discoveries must be there.

The leather industry in the West during the last fifty years has taken tremendous strides in manufacturing techniques as well as in the science of leather, and this was possible only through extensive and organised research. India, being the largest source of hides and skins in the entire world, has a natural right to play a leading part in this industry. All these years she was satisfied with merely exporting. It should now be realised that this is frittering away of national wealth. Research is said to be the handmaid of industrial progress, and in the case of the Indian leather industry advancement will be possible only through research.

Though there are at present leather trades institutes in the major provinces and States, they have primarily been training institutions for operator and foremen types of personnel for the leather industry and have not undertaken scientific research on a scale commensurate with the needs of the industry.

The Leather Research Committee of the Council of Scientific and Industrial Research, set up in 1944 at my suggestion, was the first attempt in this country to seriously examine the possibilities of planned and co-ordinated scientific research in leather manufacture, and on their recommendations the Council is financing leather research on a planned basis in several centres; the most important are the block grant of Rs. 60,000 per year to the Department of Leather Technology of the University of Madras and a grant for a five-year programme of work at the Bengal Tanning Institute, Calcutta. In order to develop the Leather Industry of India along modern lines and bring it on a level with the highly progressive leather industries of Europe and America this Committee recommended the early establishment of a Central Leather Research Institute.

Leather Manufacturers' Research Association

The research-association idea is primarily to help the small firms; and the structure of the leather industry in India is such that a research association will benefit the entire industry. A research association is an organisation established under the Companies Act, for co-operative research by firms in an industry or a group of related industries. They appoint their own staff, make their own arrangements for carrying out research and draw up their own programmes according to requirements with the advice of the Government organisation. The following privileges are enjoyed by the members of a research association: (1) they can obtain technical information within the scope of the research organisation; (2) they can

recommend specific subjects for research and, on approval by the Government Body of the Association, have them investigated without further cost to the firm. The results are available to all members; (3) they can use any patent on secret process with or without nominal payment; and (4) they can ask for a specific research to be undertaken for their benefit at cost price.

The formation of research associations for Indian industries was first recommended by the Industrial Research Planning Committee which was presided over by Sri R. K. Shanmukham Chetty. The immediate constitution of such a research association of leather manufacturers was also recommended by the Leather Research Committee.

The Council of Scientific and Industrial Research approved in principle the proposals for the Central Leather Research Institute and the Leather Manufacturers' Research Association and decided that the Institute and the Research Association should be located in the Madras Province which is most vitally interested in this industry. At the instance of Shri C. Rajagopalachari, the then President of the Council of Scientific and Industrial Research, I visited Madras and inspected various sites in the vicinity of the capital city for the situation of the Institute and in consultation with the Minister for Industries, Madras, and the Vice-Chancellor, University of Madras, selected one near the Engineering College, Guindy. The Government of Madras has made a very generous free offer of the site for the Institute. The intention is to make this Institute function as the laboratory of the Research Association.

Scope of the Institute

Hides and skins to be converted into leather have to go through the following general operations: soaking, liming, delliming, bating, pickling, tanning and finishing. These include a number of detailed operations making the whole process highly complicated. Each operation alters the skin physically as well as chemically; and chemical, bacterial and enzymic reactions, influenced by temperature, concentration, acidity or alkalinity, age of the liquors and period of treatment, play great part in these operations.

The chemistry of leather manufacture is so complex that in order to understand it one has to possess a good knowledge of chemistry, physics, bacteriology and physiology. Nowhere is the need for research so essential as it is in these complex processes, the full understanding of which still defies the scientist in spite of rapid advancements made during the last few years. The industry elsewhere has advanced rapidly by the application of scientific methods in controlling these processes, by introducing mechanised forms of production and by standardising the physical properties of leather required by the consumer by means of approved physical tests. Revolutionary changes have been introduced in the use of materials in liming, bating, tanning, dyeing, fat liquoring and other processes. Equipment and machines have been developed for operations such as unhairing, fleshing, scudding, drying and finishing.

Research as applied to the leather industry may be classified under the headings: (i) basic or fundamental research; (ii) applied research; and (iii) development research including pilot plant work.

The Indian leather industry has many pressing problems, big and small, upon which its future prosperity depends. Hitherto whatever progress was noticed it came from individual firms, but henceforth the Leather Research Institute will form the focus of all scientific activity of this industry.

HIS EXCELLENCY LORD MOUNTBATTEN, VISITOR, INDIAN INSTITUTE OF SCIENCE

ON Wednesday, the 28th April 1948, His Excellency Lord Louis Mountbatten, Governor-General of India, and Visitor of the Indian Institute of Science, accompanied by his daughter, spent about an hour in the premises of the Institute going round the several laboratories with Mr. E. V. Ganapathi Iyer, the Director.

Addressing the members of Staff and students of the Institute at the end of his visit, His Excellency referred to the importance of the work of the Institute for the scientific and industrial progress of the country and assured the members that the National Government were keenly conscious of the potentialities of science as a powerful factor in the development of the country and had been extremely enlightened and liberal in financing the several expansion schemes sponsored by the Governing Council. He expressed the hope that the department of Aeronautical Engineering which was one of the new departments of the Institute and had special scope for work in collaboration with the Hindustan Aircraft Factory, would make valuable contributions to the development of the aircraft industry in India.

TROPICAL MEDICAL CONGRESS

(Secretary of State George C. Marshall's Welcome Address)

ON behalf of the Government and the people of the United States, I welcome this distinguished gathering of scientists, physicians and public health officials to Washington. We are honoured to be host to your joint Congresses and the Department of State, along with other Government agencies and professional societies, is happy to sponsor your sessions.

Since your last meeting at Amsterdam in 1938, the world has passed through a terrible ordeal which threatened to cancel out the progress mankind had slowly and painfully achieved through centuries of sacrifice and toil. By a supreme effort civilization was saved and in the process new discoveries and inventions added to the store of man's accumulated knowledge. The human race has been given another opportunity to develop an enlightened and enduring world order. The vigorous reassertion of man's constructive talents, as exemplified by this gathering of delegates from 41 countries, is reassuring to our hopes for the future.

The concentration of some of the best minds and most zealous spirits of many lands on common objectives in these conferences is convincing evidence that our world is not a conglomeration of geographic entities but a vast neighbourhood of peoples. We can fly around the world now in less time than is required for the incubation of most diseases. In the modern world isolation in the medical sense is as impossible as political and economic isolation. There is no way we can escape the consequences of each other's mischief or misfortune. There is no acceptable alternative to learning to live together in harmony and well-being.

Role of Medical Profession

The professions you represent are in the forefront of this great humane endeavour. Statesmen and men of affairs usually and unfortunately must deal with urgent, immediate problems—the effects, and not the causes, of the discords that mar human relationships. Seldom are we able to get at the remedy for the mass misery that develops discontent, misunderstanding and violence. That is your particular province, in which you labor as benefactors of mankind.

It would be a great gain if all the prosperous and the well-fed realized as well as you do that the overwhelming majority of the plain people of the earth are still primarily and necessarily concerned with the rudiments of life—enough food to eat, clothes to wear, decent shelter, and relief from hunger, pain and debilitating sickness. Until these fundamental needs are somehow met, the human race can never achieve the degree of development which is necessary to a peaceful contented world.

The conquest of diseases which hold millions weak and inefficient, the maximum production of foodstuffs on lands now yielding little are tremendously important requirements of the world situation. The tropical regions, in large measure, hold the key to both these necessary advances. They produce large quantities of materials required by the industrial areas of the temperate zones, but the potentials of the tropics largely remain to be developed. The tropical countries do import industrial products, but that market is only a fraction of what it might be.

Conquest of Tropical Diseases Will Benefit World

The tropics are the habitation of perhaps half the human race, but a large portion of these people lack greatly in the advantages of modern civilization. A chief factor in restricting improvement in these respects is tropical disease. Little imagination is required to visualize the great increase in the production of food and raw materials, the stimulus to world trade, and above all, the improvement in living conditions, with consequent social and cultural advances, that would result from the conquest of tropical diseases.

This situation presents a challenge that, like the Equator, cuts across national boundaries and local interests. It is an international problem and it should be solved by a pooling of the genius and the resources of many nations. That it is not insoluble from the medical standpoint has been demonstrated by numerous projects with which you are familiar. The task of convincing the Governments and peoples most concerned of the feasibility of controlling and eventually eradicating disease throughout the tropics will be measurably advanced by the discussions at this conference of the latest discoveries of resarch and the modern techniques in public health.

The achievements and the aims of the cooperative effort represented by these meetings emphasize anew that, man has so far more to gain by uniting in a common fight against his real enemies, such as disease, than by internecine strife on his own kind.

This spirit of generous co-operation for the common good, I am sure, will permeate all your meetings and will assure the notable success which I and my fellow American wish for your joint Congresses.

—*USIS.*

THE SPIKE DISEASE OF SANDAL

M. SREENIVASAYA
(*Indian Institute of Science, Bangalore*)

Host Plant, the Fundamental Centre of Interest

THE sandal plant is influenced by its associated host plants with regard to its (*a*) growth, (*b*) seeding, (*c*) heartwood formation and (*d*) resistance to insect attack and spike disease.

Experimental and ecological evidence has been obtained to support the view that at no stage of its life can the sandal plant afford an independent existence with a normal functioning of all the above physiological activities.

The associated host plants, therefore, constitute the fundamental centre of interest, whatever be the line of approach, particularly in a study of the problem of spike disease.

It is well known that, generally, the physiological condition of the plant determines its predisposition to disease or insect attack, and this condition, in the case of the parasitic sandal, has been found to be influenced by its host plants.

The variety and quantity of insect fauna infecting a sandal, therefore, depends upon the floristic composition of the host group nourishing the plant.

Specificity of Association of Insects in Relation to Specific Host-Sandal Combination

Entomological collections of Mr. Chatterjee lend support to the above statement. The specificity of association of certain species of insects with certain definite host-sandal combinations has been established.

The practical significance of this discovery is realized if attention is called to the fact that the composition of the sap of sandal could be controlled through a judicious choice of host plants so as to render the sap distasteful or repulsive to certain classes of insects and possibly to vectors of disease, yet conclusively undetermined.

Types of Immunity

Disease-transmission studies under controlled conditions have revealed the existence of two types of resistance among sandal plants—(*a*) Autogenic resistance exhibited by certain plants which is largely independent of the nature of the associated host plant, (*b*) Acquired resistance, built up by the sandal if certain species of hosts and certain conditions of environment are provided.

Ecological evidence also lends support to the existence of both types of sandal plants. Strains of sandal inherently resistant to disease are often encountered in heavily-spiked areas, and with regard to the other type of resistance, floristic surveys have shown that the incidence and spread of disease is dependent upon the floristic composition of the area.

The discovery of these factors of disease-resistance among sandal plants constitutes an advance of great practical importance, as these facts are helpful in the establishment of sandal forests with resistant stock, reinforced by hosts known to impart immunity to sandal.

Two such areas have already been started in North Salem.

Haustorising Capacity—A Guide to Resistance

The property of autogenic resistance has been correlated with a high haustorising capacity and a comparatively large root system in the seedling stage of the sandal, thus affording a useful and practical guide to the selection of resistant strains. Attempts are now being made to discover a simpler morphological index easily recognisable in the seed itself.

Among the host plants through which sandal acquires relative immunity, are *Cassia siamia, Casuarina, Melia indica, Murraya, Koenigii, Dudonea viscosa, Semicarpus aancardium, Ficus bengalensis, Sarcostemma brevistigna, Ruta graveloens.*

Resistant and Susceptible Hosts

Among the host plants which have been found to render sandal particularly susceptible to disease are *Acacias* in general, *Pongamia glabra, Lantana camara, Cajanus indicus, Divi divi, Ocimum sanctum.*

It is obvious that the flora associated with sandal areas could be divided into two groups: (1) those which impart disease resistance to sandal and (2) those which render it susceptible to disease. This classification can be based either upon (1) direct experimental evidence or (2) indirect evidence based on ecological surveys.

The practical knowledge gained through both these sources has been utilised in the opening of regeneration plots in North Salem. Confirmation of the "susceptible" character of *Pongamia* and *Cajanus indicus* has already been obtained under sylvicultural conditions at Javalgiri.

Artificial Transmission

Artificial disease transmission through grafts constitutes an extreme type of infection, and a plant resistant to this operation would naturally tend to approach a strain possessing perfect and unqualified immunity. In the course of transmission studies, several such types have been obtained and these have been utilised for stocking an area at Javalgiri.

Grafts do not always take; organic fusion of the graft with the operated stock is necessary for effective transmission of disease. Sometimes the disease does not manifest itself in spite of intimate fusion, sometimes the graft is unsuccessful and in yet other instances the graft is thrown out by vigorous callous formation.

Resistance to Grafting in Relaltion to Environment

These laboratory findings have found confirmation under sylvicultural conditions. At Javalgiri about 80 per cent. success was obtained with regard to disease-transmission through grafts, while two similar operations at Mahadeswarangudi area have resulted in a complete failure of infection. The explanation to this remarkable and encouraging phenomenon is to be sought in the strikingly different floristic aspects presented by those two areas. Grafting under sylvicultural conditions, therefore, affords a useful technique for determining the susceptibility or resistance offered by environment to disease.

Root System of Host in Relation to Disease-Resistance

Among the other factors of environment which predispose sandal to disease, depth and extensiveness of the root system of the associated host play an important part.

Pot-culture studies have shown that, with a given sandal-host combination at any given age, the plants growing in bigger pots are more resistant to disease than those in smaller ones; the greater the volume of soil commandeered by the root system, the greater will be the nutrition made available to the parasite sandal.

The root system of the host plant which is parasitised by sandal may be looked upon as an extension of the root system of sandal itself. Deep-rooted hosts, in general, are beneficial to the parasite, not only with regard to its growth but also in building up immunity to spike.

The soil profile studies which have been made in this connection have revealed that spike areas are characterised by a poor root system both as regards depth and intensity.

In the choice of host plants for sandal, preference should be given to those species which possess deep and extensive root systems.

Sandal Itself, a Powerful Denuding Agent

In this connection the effect of sandal in restricting the regeneration of the root system of the host plant, has to be considered. This effect becomes pronounced when the parasitism on the host is heavy. In other words, the importance of recognising sandal as a powerful denuding agent is apparent.

Observations show that the primary attacks of spike have always occurred in places where the sandal stock is thickest and where the major hosts are either dead or dying. Overparasitism should, therefore, be strictly avoided in the sylviculture of sandal. Regeneration of the parasite should be controlled and a judicious thinning of sandal, having regard to the availability of host plants, should be worked upon as a recognised sylvicultural practice. Other plant parasites in the area should be systematically eliminated, since their presence would tax the nutritional resources of the environment.

Parasitised Hosts do not Stand Coppicing

Pot-culture studies have shown that sandal plants, when deprived of their host plants, succumb to the disease quicker. Host plants, parasitised by sandal on coppicing, rarely, if ever, put forth shoots. Field observations at Nognoor and Thalli points to the same conclusion.

These observations have a pertinent bearing on the sylviculture of sandal. No exploitation involving the deprival or weakening of host plants should be encouraged in sandal-bearing areas. All the host resources of the area should be conserved and consolidated for the vigorous and healthy growth of the parasitic sandal.

Masking of Disease

Experimental transmissions have shown that a sandal plant kept continuously under shade is more susceptible to disease than a corresponding one kept exposed to the sun. The "shade" plants take on grafts with a higher percentage of success and succumb to the disease in greater numbers. This lends experimental support to the observations of Rao Bahadur K. R. Venkataraman Ayyar who has always held that plants "under suppression" are predisposed if not actually infected. On exposure to the sun, these plants manifest the disease symptoms;

and the "shade" plants grafted with disease tissue behave in essentially the same manner with the bursting of new buds in response to the stimulus of sunshine.

"Suppression" or "shading" of young sandal should, therefore, be strictly avoided in the sylviculture of sandal.

In the course of transmission studies, it has been found that some sandal plants mask the symptoms of disease for long periods. In such cases defoliation of the plant has helped in forcing out the symptoms of spike. The plant, during the period of "mask", puts on girth and height.

Under sylvicultural conditions also this phenomenon of masking has been observed. In every infected area dozens of such plants may be found; in Manchi, for example, about 20 per cent. of the stock in the area were found to have been already infected.

Pollarding, an Important Technique to Force Out Symptoms

Sandal plants which thus mask the symptoms, constitute the sources of infection, since it has been shown by experiment that the disease can be transmitted to other healthy sandal plants by grafting some of their tissues.

Eradication of "spike" would not, therefore, be complete unless such sandal plants masking the disease are also eliminated. Non-removal of such apparently healthy sandal plants has been mainly responsible for the successive recrudescence of disease in an area, often in epidemic proportions.

In any scheme of eradication of spike, therefore, it is essential that pollarding should be adopted as a means of detecting "masking" trees. In the Manchi and Galigattam spike areas, this useful technique has been put into operation.

Disease Localised and Ringing Prevents Further Spread

Laboratory experiments have shown that the disease is localised in the initial stages of infection and that the transport of the casual entity to other parts of the plant from the site of infection is slow. Ringing at the right place and at the right time will prevent the spread of disease to other organs of the plant and save the tree from spiking.

The practical application of this information in the control of spike is limited by the fact that under sylvicultural conditions one does not know the site of infection.

During the operation of pollarding, however, it is possible that fortuitous decapitation of virus-infected branches may lead to elimination of infective organs and save the rest of the plant.

Season of Infection

It has been definitely ascertained that the actual infection occurs during April and May, which corresponds with the period when scars and other injuries are intensively inflicted on the sandal plant through some agency yet undetermined.

Season of External Manifestation of Symptoms

The symptoms of spike tend to manifest themselves on infected sandal plants during the season which corresponds with the vegetating period of sandal. In April, May and June, under the stimuli of moist-heat and sunshine, the disease manifests itself with the growth of the new flush from the dormant buds.

This information is very useful in fixing the season during which a vigilant watch has to be kept over sandal-bearing areas when fresh attacks may be expected in large numbers.

Shift of Season

Shift in the season of maximum disease incidence, may occur due to natural causes, which result in forcing out new flush in sandal plants. Forest fires and browzing by herds are the two main causes which effectively alters the period. The season during which fires occur is known to forest officers, and soon after its occurrence the epidemic should be looked for.

Primary Attacks Associated with Denuded Spots

Primary site of attack, so far as our present observations indicate, are characterised by marked changes in floristic composition, the change always accounting to a degradation towards the scrub xerophytic type of vegetation.

Deep-rooted species are replaced by shallow-rooted and deciduous shrubs of the lantana type, thus rendering moisture and nutrients from deeper layers unavailable to sandal.

This degradation is often found to be the combined result of exploitation, fire, over-parasitism, grazing and other denuding factors.

Effective measures for the protection of these denuding agents, should be laid down and rigidly enforced.

Lantana and Spike Disease

The frequent association of lantana with spike trees has led us to believe that it has some relation with spike disease. Laboratory experiments have shown that lantana is one

of the plants which renders sandal susceptible to disease. The more serious aspect of lantana is its aggressive spread with the gradual elimination of all useful species in the area. Its growth renders the soil toxic to most other plants which die in course of time. The ease with which lantana catches fire during the hot weather renders it a dangerous source of combustible material, and consequently the cause of frequent fires which accelerate the denudation of the area. Bird-life becomes scarce in lantana areas which proportionately encourages an abundance of insect fauna and possibly an increase in the concentration of the vectors of spike disease.

Elimination of lantana is a problem of great importance not only from the point of view of spike disease but also from the view-point of general sylviculture.

Elimination of Lantana Effects Remarkable Ecological Changes

It has been found that keeping down lantana artificially has a marked influence on reducing the incidence of disease, as found in Cairn No. 53, Observation area. This fact is due to the circumstance that continual weeding out of lantana has enabled other beneficial species to come up, and the ecological change that has been effected in the area during a period of seven years was remarkable.

The survey has revealed that, out of the 57 species of plants occurring in the lantana-free area, 21 are exclusive to the plot and are entirely absent from the lantana-infested area; with regard to the other species occurring in both plots, they decidedly preponderate in the lantana-free area, where one cannot fail to notice that the plot has been well stocked not only with sandal but also with host trees.

This is a striking instance where, through human effort, a restoration of the deciduous high forest type of vegetation has been effected through the simple operation of weeding out lantana and the practical bearing of this fact on the control of spike disease is quite obvious.

Haustorial Spread of Disease not a Serious Factor

Effective artificial transmissions through haustoria so far achieved does not exceed 8 per cent., and, therefore, under sylvicultural conditions the spread of disease through roots is possibly very small. The secondary spread of disease is in consequence largely effected above ground through some agency, yet to be identified.

In the practical control of disease, therefore, factors operating above ground demand relatively more serious consideration.

Arsenical Preparations to Combat Spike

Effective removal of the sources of infection should be the immediate objective so far as diseased areas are concerned. Application of Atlas and other arsenical preparations as prescribed by Dr. A. V. V. Iyengar, have been found to be most effective agents in rendering the causal entity in the entire plant innocuous. The arsenic does not appear to interfere with the valued essential oil in the heartwood.

Scars, a Measure of Disease Incidence

In the absence of any statistical information ragarding the relative abundance of insect fauna in the various observation areas, a study of the scars has been helpful in obtaining a comparative idea of their existence or activity with respect to sandal. Results indicate that the intensity of attack on sandal, as measured by scars, is roughly proportional to disease incidence.

A Practical Scheme for Disease Control

Methods of disease control are necessarily preventive in nature, since there has been, so far, no instance of a plant recovering from spike. The root stimulation and injection experiments which were in the main intended to cure the disease, gave negative results. Even if a certain constituent should, in the course of future investigations, prove an effective cure for the disease, the practical application of the discovery would be beset with insurmountable difficulties. It would be well nigh impossible to deal with every diseased sandal plant by injecting the chemical, when large areas of spike as obtained in practice are encountered.

In considering methods of prevention, we have to take cognizance of the fact that the sandal occurs in widely scattered areas and grows under different conditions. The methods of control in consequence will have to be modified in accordance with the nature of the area. The following is an attempt at classification of sandal areas from a sylvicultural point of view.

In devising methods of prevention and remedy the following five kinds of sandal-bearing areas merit consideration :—

(*a*) What are the precautionary measures to be adopted in healthy areas, at present, far removed from sources of infection ?

(*b*) By what methods can we prevent a

further spread of spike into healthy areas which happen to lie in close proximity to sources of infection ?

(c) What are the operations necessary to prevent a predisposed area from succumbing to disease ?

(d) What is the most effective and economical method of dealing with spiked areas ?

(e) What is the best way of regenerating new sandal areas, which will ensure its freedom from "spike" ?

Attention has been called to the fact that the primary sites of attack are always associated with denuded areas where a visible change in floristic coposition is effected. Prevention of this change would naturally constitute the best means of protecting healthy areas. Among the denuding factors which should be prevented from operating in any of the sandal areas, are :—

(1) Over-parasitisation due to a disproportionate regeneration and growth of sandal to be checked by judicious thinning.

(2) Other plant parasites of no economic value like loranthus, viscum, opilia, etc., which should be systematically eliminated from the area. These parasites as indicated before, deplete the nutritional resources of the environment.

(3) Exploitation of timber and fuel from sandal-bearing areas should either be totally avoided or scientifically controlled.

(4) All possible recognised methods of fire control should be rigidly enforced.

(5) Lantana and other aggressive weeds should be kept down, and open areas which might be invaded by these species may be planted up with some useful species.

(6) All species showing symptoms of 'spike', *e.g.*, *Z. œnoplia*, *Dudonea viscosa*, *Jasminium*, etc., should be promptly weeded out.

Other predisposing factors which have also a bearing on the sylviculture of sandal should be eliminated and the sandal plants should be enabled to build up resistance to disease. In this conection, the following suggestions are offered :—

(1) If afforestation of the area is contemplated, deep-rooted and "resistant" host plants, indigenous to the country, may be introduced into the area.

(2) "Shading" or suppression of sandal plants should be strictly avoided.

The above suggestions apply particularly to (*a*) and (*b*).

With regard to (c), where the ecological change has already been initiated or completed, a reversal of the conditions to the original state constitutes the most rational means of checking the incidence and spread of spike.

The main problem in such an area would involve :—

(1) The elimination of lantana and other shallow-rooted and aggressive species invading the area ;

(2) the encouragement of the deep-rooted indigenous species to come up either naturally or through sowings. In this connection, attention may be called to the remarkable ecological change that has been artificially brought about in Cairn No. 53 at Javalgiri ;

(3) a partial thinning of sandal plants may be effected to reduce the sandal-host ratio and to cut down competition for the available nutriment in the area ;

(4) "spike"-bearing weeds should be systematically eliminated ;

(5) fire protection, which might otherwise lead to further degradation of the area, should be enforced ;

(6) in the case of sandal plants which look predisposed or suspicious, masked symptoms should be forced out by pollarding the tree. If, subsequently, the plant remains healthy, it would establish that the area is free from disease ; if, on the other hand, the plant manifests the disease symptoms, it is always safe to assume that every sandal in the area is infected. A wholesale pollarding should generally be adopted as a routine.

Areas coming under the group (*d*), should first be treated in the following manner :—

(1) Immediate effective elimination of 'Spike' plants should be the first operation. The application of arsenical preparation have been very useful in this connection.

(2) Other sources of infection like (*a*) 'masked' sandal trees, (*b*) weeds suffering from spike and (*c*) the viruliferous vectors whose existence has been suspected but not experimentally established, should be considered.

The area may be then treated in exactly the same manner as if it were (*c*).

Note.—The cost of printing this article has been met from a generous grant received from the National Institute of Sciences, India.

PIPRI RIHAND DAM MULTI-PURPOSE PROJECT, UNITED PROVINCES, INDIA

THIS is one of the great multi-purpose schemes to be soon undertaken in India, by the U.P. Government. This contemplates the harnessing of the river Rihand which is a tributary of the great Sone River and aims at producing 2·2 lakh kilowatts of electric power by impounding the colossal volume of 400,000,000,000 cubic feet of water with a concrete gravity Dam across the "Rihand" river at Pipri, about 3,085 ft. in length and 300 ft. in height. The Dam site and section have been approved by Dr. Savage, Chief Designer of the famous T.V.A. scheme of America. The total cost of the Project is estimated to be 16 crores, and the cost per unit of power generated is anticipated to be only 1·3 pies, a figure unsurpassed anywhere in the world except in case of a few schemes in Sweden, Norway and Canada, where Nature is particularly generous.

For generation of Power at Pipri a minimum flow of 6,000 cusecs. will be maintained in the river all the year round which would irrigate lakhs of acres in the neighbouring province of Bihar. This minimum flow throughout the year will, therefore, admit of inland navigation for cheap transport from Calcutta right up to the border of the Rewa State, close to which the power is generated on the same lines as in the American T.V.A. scheme. The construction of the huge reservoir will also serve to moderate the intensity and frequency of floods in the region. The generation of power would be at a site in U.P. which is near the borders of Bihar, Orissa and the Rewa State. The power transmission lines could thus be linked up by a grid with those for power to be generated in the Damodar Valley of Bihar and the Hirakud Dam scheme of Orissa, the foundation stone of which was laid a few days ago by the Prime Minister of India. The power generated at Pipri is to be mainly utilised for the purpose of industrial, agricultural and domestic consumption in the neighbouring districts of U.P. and a part also in the Rewa State. This huge scheme will thus give an immense impetus to great industrial and agricultural expansion schemes in this backward region of India.

K. D. JOSHI.

INTERNATIONAL BUREAU OF PHYSICO-CHEMICAL STANDARDS

AT the request of "UNESCO" and by agreement with the International Union of Chemistry, the International Bureau of Physico-Chemical Standards of Brussels has accepted the task of establishing a collection of pure chemical substances of every kind (metals, alloys, mineral and organic substances, plastics, samples of biological interest, etc.) to place them at the disposal of laboratories and research workers of all countries, so as to enable them to control the nature and the purity of their own samples, or for any other research work.

The expenses for conservation, manipulation and distribution of the samples will be met by a subsidy from "UNESCO". But to constitute the collection, it has been decided to make an appeal all over the world, requesting the laboratories and the research chemists who have prepared or have at their disposal such substances in a state of sufficient purity to send a sample to the new centre thus created for the common interest of all men of science; to the sample should be attached a concise notice showing its method of preparation and purification, as well as its principal constants. However, please do not send any sample to Brussels, without first getting in touch with the International Bureau of Physico-Chemical Standards.

There may be cases, when the author of an original research wishes to keep for himself the sample of the substance he has prepared. In this case it would be of great help if he would give us a description of the sample with its constants, so as to enable us to establish a register showing where one could eventually obtain these substances.

It must be well understood that this institution, purely scientific in character, wishes in no way to compete with the chemical industry, and that products easily obtainable on the market fall outside our scope. Nevertheless, some research laboratories of the chemical industries possess samples of rare substances, prepared for their own use in small quantities, and which, therefore, are not included in the catalogues of industrial and commercial firms. Such laboratories could also render a great service to science if they were willing to play their part in the realisation of our project.

We hope that this appeal will find a large response all over the world so that the international solidarity of men of science shall manifest itself once more.

For more detailed information please write to the Director of the International Bureau of Physico-Chemical Standards, Professor J. Timmermans, Universite Libre de Bruxelles, 50 Avenue Franklin Roosevelt, Bruxelles, Belgium.

PROF. P. S. MACMAHON

BY a strange perversity of fate the two important national organisations, the Indian National Congress and the Indian Science Congress, owe their origin to the far-sighted vision of a few disinterested Englishmen. A. O. Hume, Lord Dufferin, Sir William Wedderburn and Sir Henry Cotton are credited to have laid the foundation for the first, while Profs. MacMahon and Simonsen were entirely responsible for the second. The Science Congress had attained its independence almost from its birth even though it had to be nursed by official patronage through its childhood. In its adolescence and manhood it has attained such a stature, and everything concerning it is taken so much for granted that its parenthood is almost forgotten. This is perhaps due to the extremely unassuming personality of the real parent, Prof. MacMahon, who, once he was satisfied that this child of his creation was growing fast and did not need his support any longer, kept himself completely in the background, so that many of his old friends and colleagues of the Science Congress have to be reminded that he is still in India. MacMahon always avoided the lime light. On April 30, 1948, he retired from service as Professor of Chemistry, Lucknow University, and as Public Analyst to Government of the United Provinces.

MacMahon had a brilliant academic career in Manchester University, after which he proceeded to Oxford where he carried out his classical work on the photochemical reactions between hydrogen and chlorine with Chapman. In 1910 he came to India as Professor of Chemistry in the Canning College, Lucknow, which was then an affiliated college of the Allahabad University. At about the same time J. L. Simonsen was Professor of Chemistry in the Presidency College, Madras. Both felt the absence of a scientific atmosphere and wished to start an association in India on the same lines as the British Association for the Advancement of Science. All the spadework was done by MacMahon, and it took him nearly three years to arrange for the first session of the Indian Science Congress, which was held in 1914 at Calcutta under the presidentship of Sir Ashutosh Mukerji. The Congress started with six sections, *viz.*, Chemistry, Physics, Geology, Zoology, Botany and Ethnography, while the total number of papers read were 35. In 1938, at the Jubilee Session, there were 13 sections and more than 800 papers besides general lectures and joint meetings.

Another important institution for which MacMahon is entirely responsible for its initiation and development is the Department of the Public Analyst in the United Provinces. This is a Government Department of which Professor MacMahon continued to be the Head on a part-time basis until his retirement.

When the Canning College was taken over by the newly created Lucknow University in 1921, MacMahon was appointed Head of the Chemistry Department. He was then able to persuade the authorities to reorganise chemistry teaching for which a beautiful new laboratory was built in 1929 to cater to the needs of students up to M.Sc. standard. He was unable to obtain enough funds for its proper equipment for research. The systematic financial starvation of the Universities by the Government is entirely responsible for this state of affairs. MacMahon had visited all important laboratories in England and the Continent, and knew what was needed; but it was his regret that he was unable to translate his ideas into practice with regard to the equipment of the Lucknow University laboratories for research work.

He has travelled widely, and is an extremely genial person and a perfect gentleman. He is a bachelor. He is leaving India after 38 years of meritorious service. He will be very much missed by his numerous friends, colleagues and students at Lucknow. We wish him many years of happy and peaceful life in his retirement.

M. R. N.

GEOMAGNETIC STORMS

Some details of the geomagnetic storms as recorded at the Alibag Magnetic Observatory are given in the following table in which t_0, t represent the time (I.S.T.) of commencement of the disturbance and its intense phase respectively, and T the duration of the intense phase expressed in hours. The ranges in the three different elements (D, H and V) of the earth's magnetic field have also been given, D, in minutes of arc, H and V in γ where $1\gamma = 10^{-5}$ gauss. The maximum k-indices (K_M) recorded during the disturbances have also been given.

Date	t_0	t	T	Range			K_M	Nature of commencement
				D	H	V		
1948—	h. m	h. m	hrs	Min.				
Jan. 3	11 30	16 —	8½	2·4	185	27	5	Gradual
Jan. 17	14 —	17 30	3	3·2	183	30	7	Gradual
Feb. 3-4	07 36	12 —	7	4·7	197	34	5	Sudden
March 12-15	03 08	..	5	4·1	180	40	5	Sudden
March 15	09 04	09 04	17	3·5	213	54	6	Sudden

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HEAT CONDUCTIVITY AND MOLECULAR WEIGHT OF LIQUIDS

THE author[1] has shown previously, after Osida,[2] that the heat conductivity of a *dielectric* liquid is determined *inter alia* by the vibration frequency of its molecules. The frequency of vibration of a particle, executing monochromatic vibrations about its position of equilibrium in a space lattice, varies inversely as the square root of its mass.[3,4] It is of interest to find out, therefore, whether any such relationship exists between the coefficient of heat conductivity, K, and the molecular weight, M, of a liquid.

K varies with temperature, *t*.[5–7] It is necessary, therefore, for the above investigation, to accumulate data on K for different liquids at a corresponding temperature, *e.g.*, the boiling point. Further, since various methods of measurement of K give slightly different values, data obtained by any single method are only strictly valid. Measurement of K at the boiling point is not possible. The heat conductivity at the boiling point $K_{B.P.}$ for a particular liquid can, however, be obtained from values at two (different) temperatures, assuming a linear relationship between K and *t*. In the accompanying table are shown the boiling points (B.P.), M, $\sqrt{M}$, $K_{B.P.}$ (obtained from Bridgman's data[6] at 30° and 75° C.) and $K_{B.P.}\sqrt{}$ for twelve different liquids of widely varying M and K. The molecular weights M are those of the vapours.

As will be evident from the last column in the table, the product $K_{B.P.}\sqrt{M}$ is approximately a constant, except in the case of water. It has a mean value of 0·0030 for eleven liquids with M and $K_{B.P.}$ varying respectively from 32·0 to 156 and 0·000496 to 0·000261. That the heat conductivity of a liquid, like the frequency of vibration of its particles, should be an inverse function of the square root of its molecular mass is significant. The departure of water from this simple generalization requires further investigation.

Liquid	M	$\sqrt{M}$	B.P. (° C.)	$K_{B.P.} \times 10^3$	$K_{B.P.}\sqrt{M}$
Water ..	18·0	4·24	100	1·595	(0·006769)
Methyl alcohol ..	32·0	5·657	64·7	0·496	0·002805
Ethyl alcohol ..	46·1	6·790	78·3	0·415	0·002818
Acetone ..	58·1	7·622	56·5	0·414	0·003156
Isopropyl alcohol	60·1	7·752	82·2	0·362	0·002806
Normal pentane ..	72·1	8·491	36·2	0·319	0·002709
Ether ..	74·1	8·608	34·6	0·328	0·002823
Normal butyl alcohol	74·1	8·608	117·5	0·383	0·003297
Carbon disulphide	76·1	8·724	46·2	0·375	0·003271
Isoamyl alcohol ..	88·1	9·386	131	0·341	0·003201
Ethyl bromide ..	109	10·44	38·4	0·284	0·002965
Ethyl iodide ..	156	12·49	72·3	0·261	0·003260
				Mean	0·003010

My thanks are due to Prof. S. S. Joshi for his kind interest in the work.

Department of Chemistry,
Benares Hindu University,
March 15, 1948. S. R. MOHANTY.

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A NOTE ON THE OCCURRENCE OF FREE SULPHUR IN DRUSES AND CAVITIES IN THE MICA-BEARING PEGMATITES OF GOSAVID, TIRUVUR TALUK

DURING recent field work in the mica-bearing regions of Tiruvur Taluk (Kistna District) an interesting occurrence of free sulphur in druses and cavities was noticed in a pegmatite vein near Gosavid, a village which is about 13 miles from Yerrupalayam Railway station on N.S. Rly. The country rocks of the area are khondalites consisting of garnetiferous-sillimanite gneisses, mica-schists, and quartzites into which are intruded charnockites, granites, and pegmatites. The pegmatites which are intrusive into the schists are disposed parallel to the plane of foliation of the latter. They carry workable mica and have been trenched by prospectors in a number of places. A zone of narrow central quartz core is surrounded on either side by a zone of felspar in the pegmatite, and in the quartz are a number of small drusy cavities. In some of the druses a yellow powder having the smell of sulphur was observed. On closer examination it proved to be sulphur in the free state. This powder was filling the druses which were up to an inch in width and up to half an inch in depth.

So far as we are aware, free sulphur has not been reported from any of the Indian pegmatites. The minerals comprising the pegmatites are quartz, felspar, muscovite, biotite, apatite, tourmaline and chalcopyrite. Chalcopyrite is very subordinate and occurs as sporadic stringers in the associated quartz.

The occurrence of free sulphur in a pegmatite is peculiar, and is of great academic interest. The trench was under excavation during the period of the survey of the area. No gun powder or dynamite were used for opening out the trenches and the excavation was done entirely with crowbars and wedges. The pegmatite vein up to this deposit was disintegrated and blocks of the vein material could be easily dislodged and removed without blasting. The druses with free sulphur occur at a depth of about 25 feet from the surface and in the zone of vadose circulation. Chalcopyrite stringers and lenses occur within about a foot from these druses.

One possibility which suggests itself is to consider this occurrence of sulphur as having been deposited as a sublimate in pneumatolysis. The association of chalcopyrite in close proximity is significant, as it points to the presence of sulphides in the emanations. Since, however, the sulphur was found within the limits of meteoric circulation in a vein which was highly fractured and disintegrated, the possibility of its having been derived from chemico-organic decomposition of the chalcopyrite cannot be ignored. Alteration of sulphide minerals by meteoric water is too well known to require elaboration. In a recent paper Schouten[1] recognises the possibility of the role of special bacteria in the reduction of sulphur-bearing minerals. It is conceivable that the chalcopyrite might have undergone oxidation by meteoric waters to a sulphate, and sulphur-reducing bacteria might have altered it to free sulphur, the possibility of which is indicated by Schouten,[1] Ganapathi[2] and Iya and Sreenivasaya.[3] If chemico-organic origin of this sulphur is admitted, it is not improbable that the druses were themselves originally filled with chalcopyrite. The main purpose of this note is to record the occurrence of free sulphur in mica-bearing pegmatites of Gosavid, Tiruvur Taluk. Alternative suggestions have been put forward to account for their origin.

Andhra University,
Geology Dept., C. MAHADEVAN.
Waltair, N. GOPALAKRISHNAMURTHY.
March 29, 1948.

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SYNTHESIS OF ββ-DIMETHYL, ββ-DIETHYL ADIPIC AND CYCLOHEXANE AND CYCLOPENTANE-1-ACETIC-1-PROPIONIC ACIDS

BAYER'S strain theory suggests, under conditions, where glutaric and β-substituted glutaric acids yielded a cyclopropane ring, the adipic and corresponding substituted adipic acids should facilitate the formation of cyclobutane ring; but Thorpe Ingold valency deflection hypothesis points to the contrary. The present investigation was undertaken with the idea of verification of either view, which field remained unexplored, for the synthesis of such substituted adipic acids was attended with considerable difficulty. The usual methods for the conversion of a lower dibasic acid into a higher one fail when applied for the preparation of substituted adipic acids. It was, therefore, proposed that attempts to introduce a methylene group in one of the free arm chains carrying carboxyl groups in glutaric acid (β-substituted), be made. A method was devised on the lines, based on the conversion of orthonitrobenzonic acid into orthonitrophenyl acetamide,[1] and experiments were started to convert (*a*) ββ dimethyl, (*b*) ββ diethyl glutaric acids into corresponding adipic acids and (*c*) cyclohexane, (*d*) cyclopentane-1-1-acetic acids into corresponding cyclohexane cyclopentane-1-acetic-1-propionic acids. The acids

(*a*) and (*b*) were prepared by Thole and Thorpe's[2] and Deshpande and Thorpe's[3] methods; (*c*) and (*d*) by Thole and Thorpe's[2] and Norris and Thorpe's[5] methods. These acids were then converted into their anhydrides and then into mono (acid) esters. The half esters were then treated with Thionyl chloride. The chlorides formed were allowed to react with diazomethane at $-20°$ C. in dry ether. The reaction mixture in each case was kept overnight, during which time the maximum temperature was not allowed to rise above 18° C. The residue obtained from the above was treated (in alcoholic ammonia) with a 10 per cent. solution of silver nitrate and the reaction mixture was then heated to 70° C., filtered while hot. The filtrate on dilution deposited the amide of the required acid which was hydrolysed under reflux with 10 per cent. caustic potash. The alkaline mixture was cooled and then acidified with 2-N sulphuric acid. The acidified solution was saturated with ammonium sulphate and repeatedly extracted with ether. The ethereal extracts were combined, dried, with sodium sulphate and the solvent removed. A slightly sticky brownish mass was obtained in case of (*c*). It was washed with chloroform and the white solid left after chloroform treatment, was washed with petroleum ether and crystallised from benzene. On examination, it was found to be the desired product, cyclohexane-1-acetic-1-propionic acid, M.P. 169° C. In case of (*d*) the residue, which was semisolid and sticky, was washed with chloroform and on crystallisation from ether gave a white crystalline substance, M.P. 173°C. This was found to be cyclopentane-1-acetic-1-propionic acid. In case of (*a*), the combined ethereal extract yielded, on drying, a lactone which was identified as $\beta\beta$ dimethyl-valerolactone, M.P. 29°-30° C. and B.P. 234°-235° C. It was then converted into the required acid by Gustave Blank's method.[6] The acid melted at 87° C. In case of (*b*) the ethereal extract yielded on drying, a liquid residue, yellow in colour. The residue was distilled under reduced pressure, and a light yellowish oil was obtained from it at 138° C./42 mm. When this oil was removed from the pump and the liquid acquired room temperature and pressure, white needles separated from it. The crystalline substance was separated from oily mother liquor and recrystallised from ether and examined. It was found to be the required $\beta\beta$ diethyl adipic acid and melted at 133°-134° C. The liquid which remained after the removal of the acid was found to be lactone, B.P. 136°-138° C./20-22 mm.

Chemical Laboratories, L. D. TEWARI.
Allahabad University, J. D. TEWARI.
February 4, 1948.

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OIL FROM THE SEEDS OF *ZIZYPHUS XYLOPYRA* (WILLD.)

AN amber coloured oil whose constants are given below, was extracted out with petroleum-ether in 10 per cent. yield from the seeds of *Z. xylopyra* (N.O. Rhamnaceæ) obtained from Katyani, six miles south of Kolhapur.

Sp. gr. at 26°, 0·9121; $n_D26°·5$, 1·4725; Iodine value (Wijis), 84·36; Acid value, 10·7; Acetyl value 16·6; Sap. value, 192·8; R-M value, 1·01 and Polenske No., 0·20.

The unsaponifiable matter (0·8 per cent.) consisted of a sterol, m.p. 208° C. (acetate m.p. 62° C.). The insoluble mixed fatty acids (yield 96 per cent.; Iodine value 87·06) obtained by saponification with alcoholic potash and removal of unsaponifiable matter, were fractionated by the lead salt method in the usual manner into saturated acids (28·1 per cent.) consisting entirely of myristic acid (m.p. 53·8° after crystallisation from 80 per cent. acetone; mol. wt. 226) and unsaturated acids (71·9 per cent.; Iodine value 121·7; mean mol. wt. 281·7). The latter gave on bromination in acetic acid solution at 15° C., an oily mixture separated by treatment with ether and petrol into linoleic acid tetrabromide, m.p. 113° C., (Br. 53·5 per cent., corresponding to 34·22 per cent. of linoleic acid) and oleic acid dibromide (Br, 34·6 per cent., corresponding to 65·78 per cent. of oleic acid). Apart from myristic no other acid could be isolated from the saturated acid fraction even by intensive fractional crystallisation from 30 per cent. acetone.

My thanks are due to Prof. J. G. Chohan, Head of the Biology Department, Anand College, for identifying the seeds and to Mr. G. N. Pandit for his co-operation during the preliminary stages of work.

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March 11, 1948.

"ANILINE POINT" OF FATTY OILS

OF late there is considerable adulteration of groundnut and cocoanut oils with the so-called technical white oils. There is no ready method of detecting the white oil in the fatty oil and its content is commonly determined either by per cent. unsapofiable matter or by sap value and/or I.V. In an attempt to find out a method which will be short and at the same time simple and fairly reliable, it was observed that 'Aniline Point' is used in the differentiation of paraffin, naphthene and aromatic hydrocarbons. It is defined as 'the temperature of separation into two layers of the equal mixture (of aniline and the sample) when it is gradually cooled down from a temperature at which it is homogeneous.'[1] Thus it is analogous with the critical solution temperatures of fatty oils as represented by the Valenta and Crismer values.

Using distilled aniline and genuine samples of the edible fatty oils and white oils, the following aniline points were obtained:—

Oil	Aniline Point—° C.
Groundnut oil ..	16·7
Coconut oil ..	3·2
Sesame oil ..	8·1
White oil I ..	97·5
,, II ..	92·5
,, III ..	93·8
,, IV ..	107·0
,, V ..	108·8

There is thus a large difference between the Aniline Points of the three edible oils on the one hand and of the white oils on the other. It should, therefore, be possible to estimate the mineral oil content down to one to two per cent. The following table gives experimentally determined 'Aniline Points' (uncorrected) for mixtures of groundnut oil and white oil I.

% White oil	Aniline Point—° C.
0	17·0
1·1	18·0
2·0	19·0
3·0	20·0
10·9	27·1
19·7	35·2
30·0	45·0
40·0	52·8
100·0	97·0

These points are to be taken more as indicating their change with composition rather than showing any exact relationship with it. A closer investigation of the various factors involved and of the use of Aniline Point in the field of fatty oils is in progress.

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University of Bombay, J. G. KANE.
April 9, 1948.

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AN EASY METHOD OF OBTAINING EPIDERMAL PEELS OF GRASS LEAVES

THE grass leaves, on account of their anatomy, offer considerable difficulty in removing sufficiently large and satisfactory peels of the epidermis. The usual method of raising the epidermis with a sharp razor or scalpel and peeling off with a pair of forceps fails very often with the grass leaves. One usually gets a tear with the vascular bundles attached. Large peels, especially, with the stomatal tissues are necessary when comparisons of different varieties are undertaken. Prat[1] obtained excellent peels by working away with sharp scalpels and removing the overlying epidermal, chlorophyllous and vascular tissues. When the upper epidermis is required the teasing is to be begun from the lower layer, and *vice versa* for the lower epidermis. This method works very well with leaves of the dicotyledons, especially those with fewer vascular tissues, *e.g.*, groundnut, field beans or lablab and such plants. This technique would be too slow for treatment of materials like paddy in which we had to obtain preparations of a number of varieties, preparations of various positions of the same leaf, those of the leaves of various ages of the same plant, etc., for computing the number of silicated cells amongst the different bands of epidermal cells as rice cells, dumbel-cells, long epidermal and short epidermal cells, bulliform tissue, stomatal tissue and so forth, the area of the silicated cells in the different kinds of tissues comprising the epidermis, etc., in the evaluation of the role of silica in the resistance to blast disease.

We tried some of the maceration methods to obtain the peels quicker. Bits of paddy leaf treated with the common macerater, concentrated nitric acid with potassium chlorate, gave some peels. The disadvantage in this method is that the middle lamella becomes dissolved and the individual cells are separated with the least pressure. The macerater used in the diatom preparations was next tried. In this the leaf is boiled in a 1 : 4 or 1 : 5 concentrated sulphuric acid to which a few crystals of potassium dichromate is added in a test-tube. The contents of the test-tube are then emptied into a dish of water. After a brief washing, to remove the excess acid, the leaf bits are teased out. The exact time required for completion of the reaction should be judged by trial. Over-boiling spoils the preparations and must be avoided. On teasing out, excellent large peels are easily separated. The middle lamella being intact, entire tissues will separate out. The upper and the lower epidermis can be distinguished by the presence of the bulliform cells. Peels taken this way are not damaged in any way and hence are best suited for the study of the epidermal structures. When such peels are stained with Grob's[2] stain (Phenol and Safranin) the silicated cells stand out bright and shining and highly refractive. The non-silicated cells take on the red colour while the silicated cells remain unstained.

Cytogenetics Laboratory, S. SURYANARAYANA.
Agric. Research Institute, N. KRISHNASWAMY.
Lawley Road P.O.,
April 9, 1948.

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A MOSAIC DISEASE OF *DATURA ALBA* NEES

A MOSAIC disease affecting *Datura alba*, first observed in Poona in August 1939, has since been collected from several places in the Bombay Province.

The symptoms of disease are light green and dark green mosaic accompanied by large blister-like patches of dark green portions of leaf lamina which is much distorted and reduced in

size (Fig. 1). Diseased plants look pale due to their leaves becoming yellowish green at advanced stages of infection. Flowers are also severely malformed and distorted, but the diseased plants are seldom dwarfed.

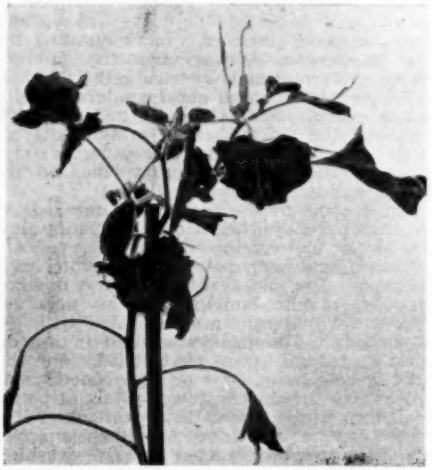

FIG. 1. A diseased *Datura alba* plant showing malformed leaves and flower

In nature, *Datura fastuosa* Linn., is also affected with the virus, but the symptom of disease is only a mild mosaic mottle.

The virus withstands heating for 10 minutes at 60° C., retains infectivity (*a*) at a dilution of 1 in 10,000, and (*b*) after storage for 13 days at laboratory temperature (80° F). It withstands treatment with 95 per cent. ethyl alcohol for 30 hours at 45° F.

The virus is readily transmitted by sap inoculation and by grafting, but not through seed. It is also transmitted by *Myzus persicæ* Sulz. from diseased *Datura fastuosa* to healthy plants of the same species an dalso to *Datura alba* under controlled conditions. In some cases only this aphis transmitted the disease from *D. alba* to *D. alba*.

In addition to *Datura alba* and *D. fastuosa*, the virus also infects tobacco, petunia and potato, and produces local necrotic lesions in *Datura stramonium* and *Nicotiana glutinosa*, but is not infectious to *Phaseolus vulgaris*, *Vigna sinensis* and *Solanum melongena*.

Smith (1937)[1] has described a virus disease affecting *Datura stramonium*, and has designated it as *Datura* virus 1; and Thomas and Krishnaswami (1939)[2] have designated the "little-leaf" virus of brinjal as *Datura* virus 2. The virus affecting *Datura alba*, described in this note, has no affinity whatsoever with *Datura* virus 2; and also shows a marked difference from *Datura* virus 1 in respect of the physical properties, its inability to cause disease in *Phaseolus vulgaris* and *Vigna sinensis*, and the production of only local infection in *Datura stramonium*. Accordingly, it is considered that the disease of *Datura alba* is caused by a new virus not described previously. It is suggested that the virus be known as "*distortion mosaic*" of *Datura alba*, and *Datura* virus 3 according to the classification by Smith.[1]

This work is being done under a scheme financed by the Indian Council of Agricultural Research.

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College of Agriculture,
Poona,
November 27, 1947.

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YELLOW MOSAIC OF *PHASEOLUS LUNATUS* L.

IN December 1939, a large number of double bean (*Phaseolus lunatus* L.) plants grown on the Agricultural College Farm, Poona, showed characteristic mosaic pattern on their leaflets. Tests with the disease proved it to be caused by a virus. This disease has also been collected from several localities in the province.

On inoculation the disease takes 20 days to a month to appear in double bean seedlings in the insect-proof glasshouse at Poona. The first symptoms of disease are the appearance of faintly discoloured patches scattered over the laminæ of leaflets. These patches gradually become bright yellow as the leaf grows to maturity (Fig. 1). Occasionally the entire leaflet becomes chlorotic.

FIG. 1. A leaflet of diseased double bean plant showing bright yellow chlorotic patches

The affected plants are not dwarfed, but continue to grow and bear normally. However,

as the season progresses the production of pods is greatly reduced, probably due to the severity of the disease in the later stages of crop growth.

The virus is readily transmitted by bud-grafting, but is neither sap-transmissible nor carried in seed of double bean. Out of 47 seeds from diseased double bean plants planted in pots inside the insect-proof glasshouse, 45 seedlings were produced, but none of these showed the disease for three months, the period for which they were kept under observation. In transmission tests with insects, the virus was readily transmitted by the white-fly, *Bemisia tabaci* Genn. (*B. gossypiperda* M. & L.), but not by *Empoasca devastans* Dist., *Empoasca* sp., *Aphis laburni* or thrips. The results of the transmission tests are given in Table I.

TABLE I

Transmission of double bean yellow mosaic virus by grafting and by insects

Transmission by	Plants inoculated	Plants diseased
Bud-grafting ..	20	14
Bemisia tabaci ..	30	30
Empoasca devastans ..	15	0
Empoasca sp. ..	11	0
Aphis laburni ..	19	0
Thrips ..	11	0

In addition to double beans, the virus also infects *Phaseolus limensis, P. vulgaris, P. aureus, Dolichos biflorus* and *Canavalia ensiformis*, but does not go to *P. aconitifolius* and *Dolichos lablab*. Amongst several varieties of *P. vulgaris* tested for infection with the virus, varieties Asgrow Stringless Greenpod and Davis White Wax were found to be resistant to infection, while variety Red Kidney was highly susceptible.

Uppal[1] reported the occurrence of a mosaic disease of *Dolichos biflorus* in this province. This disease has since been shown to be caused by the same virus which affects the double bean plants. McClintock[2] was the first to report the occurrence of a mosaic disease of lima beans, which was shown to be transmitted by sap inoculation and also by two species of aphids by Harter,[3,4] who further concluded that the disease was similar to the mosaic of cucumber and celery.[4] Although in symptomatology the yellow mosaic of double beans resembles the lima bean mosaic[4] and also Bean virus 2 of Pierce,[5] it differs entirely from both of them, as it is neither sap-transmissible nor transmitted in nature by an aphid. Accordingly, the disease in double beans is considered to be caused by a new virus which it is proposed to designate as '*double bean yellow mosaic*' virus.

Grateful acknowledgements are due to Dr. B. N. Uppal for much help and criticisms during the progress of the work. This investigation is being carried out under a scheme financed by the Indian Council of Agricultural Research.

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Dept. of Plant Pathology,
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April 30, 1948.

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POLYPLOIDY IN *PENNISETUM PURPUREUM* SCHUMACH—THE DRY NAPIER

IN the course of the study of the cytogenetics of the F_1, of *pennisetum typhoides* × *P. purpureum* (thick-Napier or Elephant grass) and its parents, the root tips of several clumps of the Napier grass were examined. Amongst these were included some of the clumps from the dry-Napier or the thin-Napier grass. The elephant grass usually grows to a height of 18 to 20 ft., with thick sugarcane-like stems and broad leaves. The thin-Napier, on the other hand, grows to about 8 to 10 ft. with thin stems and narrow leaves. The elephant grass root-tips gave consistently a somatic number of 28 long chromosomes (Fig. 1). In 1940 it was observed that a few of the root-

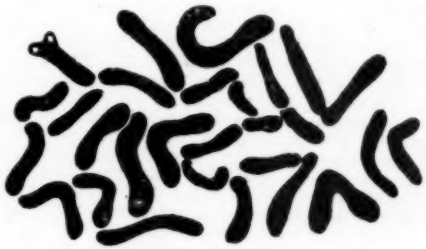

FIG. 1. Elephant grass. × 4960

tips in dry-Napier gave a greater number of small chromosomes than in the elephant grass. An examination of the root-tips of the dry-Napier now, gave again a tetraploid number of $2n = 56$ (Fig. 2). The chromosomes are nearly half as long as in the elephant grass. Only two root-tips were examined. These were collected from tillers from a clump. The tillers were brought to the laboratory and induced to root in water. No nutrient solutions were used but only tap water (within 48 hours quite a large number of roots develop easily and it has been found a convenient method of getting straight, thick roots, especially in grasses). After collection of the roots, the tillers were rejected since it was thought that the number would be the normal diploid. These two roots were, however, found to be completely tetraploid.

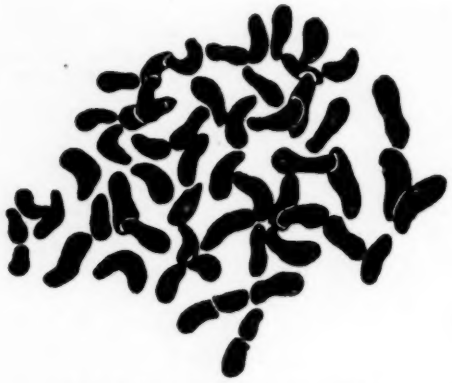

FIG. 2. Thin Napier grass. × 4960

Comparative measurements were done on twenty-five nuclei and cells of both the 4x dry-Napier and the 2x elephant grass root-tips. Only the diameter was taken on the nuclei while the length and breadth of the cells were recorded. The spherical volume was calculated for the nuclei while the area alone was compared for the cells. Gentcheff and Gustafsson[1] have also used a similar method for finding possible correlations between cell size and chromosome number. The cells were chosen from representative areas in the root meristem in both plants. The average nuclear volume in the 4x plants was found to be 577·48 cub.μ., while in the 2x it was 494·1 cub.μ. The mean area of cells in the 4x plant was 650·48 square units and in those of 2x plant 519·39 square units (one unit of the micrometer = 0·69 μ). Thus it is seen that the nuclei as well as the cells are larger in the tetraploid than in the diploid plant. Smears of the root-tips from other clumps of the dry-Napier again gave a 4x number. It is possible, therefore, that the dry-Napier may be a fully tetraploid plant. The clumps which gave the tetraploid roots are kept under observation for study of the meiosis which would then show whether the observed phenomenon is confined only to the roots or whether the entire plant is a tetraploid.

Cytogenetics Laboratory, Agric. Research Institute, Lawley Road P.O., Coimbatore, *March* 16, 1948.

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THE LARVAL PARASITE — *PLEUROTROPIS FOVEOLATUS*, C., OF THE POTATO BEETLE, — *EPILACHNA-28-PUNCTATA*

Pleurotropis foveolatus, C. (Chalcidoidea, Hymenoptera) is a common and natural, endophagous parasite, attacking the larva as well as pupa of Epilanchna-28-punctata,—a serious field pest of potato.

Adult Parasite is small, dark and shining with a wing expanse of 3 mm. to 4 mm.; the antenna is black and 7 to 9 jointed; the abdomen is ovate and more acutely pointed in the female than in the male; the legs are black with the distal joints (Tibia and Tarsus) brown in colour; the male is usually smaller than the female.

Symptom of Parasitisation.—On parasitisation the host larvæ and the pupæ change their colour from the normal yellow to a blackish-brown or black; the hosts become brittle after a few days. Wherever the parasite is active, such blackish-brown or black host larvæ and pupæ amidst the yellow and healthy ones can be easily observed.

Incidence in the Field.—The incidence of parasites was studied from material collected round about Bangalore at random (Table I).

TABLE I

Lot number	Period of observation	Percentage of parasitisation
1	25-2-47	30
2	5-3-47	33
3	14-3-47	28
4	19-3-47	42
5	25-3-47	77
6	26-3-47	72
7	4-7-47	70
8	8-7-47	68
9	17-7-47	62
10	23-7-47	61
11	24-7-47	62
12	26-7-47	77

results show the maximum percentage of parasitisation reached can be as high as 77. On an average, more than 40 per cent. of the host larvæ and pupæ is attacked and killed.

Age of the Host Suitable for Parasitisation.—Larvæ, in all stages of development, are stung by the parasite. But the first instar larvæ are not oviposited upon; nevertheless they also turn brown when stung, as individuals of the higher instars do, about 48 hours after the attack. Fully formed pupæ are not usually preferred by the parasite. The second and subsequent larval instars and early stage pupæ are thus found to be suitable for successful parasitisation and normal development of the parasite.

Period of Development of the Parasite in the Laboratory.—Laboratory-bred healthy and normal host larvæ were used singly for the developmental studies.

Period of observation: March and April 1947.
Period of development: 11 days.

After full development all the parasites from one and the same host generally emerge out on the same day; rare instances of emergence on different days have also been recorded. Usually females are found in larger numbers than the males (16 : 9) in any one lot of emerged parasites. Very rare instances of males (2 : 1) preponderating over females do occur.

TABLE II

Culture number	No of parasites emerged		
	Male	Female	Total
1	4	13	17
2	6	15	21
3	3	13	16
4	2	15	17
5	14	7	21
6	5	7	12
7	6	15	21
8	7	12	19
9	6	7	13
10	3	4	7
11	6	10	16
12	8	14	22
13	6	8	14
14	3	5	8
15	6	6	12
16	2	7	9
17	9	12	21
18	8	11	19
19	6	16	22
20	6	8	14
21	4	12	16
22	8	10	18

Number of Parasites per Host and per Pair of Parasites.—The number of parasites that emerged in the laboratory out of a single host, subjected to attack by a single fertilised female is:—Average 16; Maximum 22: and Minimum 7. .

A number of parasitised larvæ collected in the field were also dissected out and the parasite grubs and pupæ found within were counted as follows:—

Serial No.	No. of parasitised grubs and pupæ
1	12
2	8
3	14
4	23
5	23
6	42
7	38
8	18
9	22
10	26
11	14
12	33
13	18
14	16
15	23
16	15
17	24
Average ..	22·5

A maximum number of 42 parasite grubs and pupæ have thus been counted out of a single host larva, prior to normal emergence.

Stinging and Egg-Laying.—The adult female, after finding the host, perches on its back and stings it, which immediately reacts by a sudden quick movement. The parasite leaves the host after its first sting and administers another as soon as the host larva comes to normal. Though the host larva wriggles and gets overpowered after the second sting, the parasite usually stings the host larva for a 3rd time which is prolonged for over 3 to 4 minutes; eggs are laid during this period. If the host is not suited for the development of its progeny, eggs are not laid by the parasite in them.

The eggs are thrust into the host body through the soft intersegmental regions, usually on the dorsal surface; they are laid in groups just below the larval skin. The parent parasite lays eggs at intervals of 15 to 20 minutes and about three thrusts apart from the first two stings are observed.

Life-Cycle.—The egg is white, small and oval; the grub hatches out in about 48 hours after the egg is laid and commences to feed into the central region of the host body; in the early stages the parasite is yellowish-white in colour turning whitish by the time it is fully grown; the larval period extends over 6-7 days after which pupation takes place; the grub pupates in the hollow cavity of the host body caused by its feeding on the internal contents; the pupa is naked and the pupal period extends over 36 to 48 hours; the adult parasites emerge through usually one and rarely two pin-holes on the dorsal side of the embrittled skin of the host.

The high percentage of parasitisation of the Epilachna beetle by this parasite gives an idea of how much more virulent the beetle-pest could have been than at present, without the natural check effected by this parasite. This high incidence of the parasite in the field and the ease with which it can be bred in large numbers in the laboratory on the larvæ and pupæ of *Epilachna-28-punctata* (its natural host), which, in turn, can also be bred in sufficient numbers on its alternate solanaceous and cucurbitaceous host plants—such as brinjal, tomato, gourds, cucumbers—besides potato, suggest possibilities of biological control of the potato Epilachna beetle-pest.

I am grateful to Mr. B. Krishnamurti, B.SC., F.R.E.S., Government Entomologist, for his kind suggestions and general guidance.

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NOTES ON THE LIFE-HISTORY OF THE CHALCID PARASITE, *AZOTUS DELHIENSIS* LAL

Azotus delhiensis Lal has been proved to be a primary parasite of the white-fly, *Aleurolobus barodensis*, which according to Karamsingh[1] causes a serious damage to sugarcane fields in the United Provinces, Central Provinces, Bihar, Orissa and others.

Azotus delhiensis has been placed by Lal[2] in the family Eulophidæ and sub-family Aphe-

lininæ. It is widely distributed in India specially in the tracts of sugarcane-growing provinces. The genus was originally created by Howard[3] in 1898. He described the species *Azotus marchali*, reared from two specimens *Diaspis ostreaformis* on pea and another from *Aspidotus merii*.

The percentage of parasitisation was studied for two consecutive fortnights.

TABLE I

Data of Life-History of the Chalcid Parasite Azotus delhiensis

Period	Number of pupæ examined	Number of parasitised pupæ	Percentage of parasitisation	Name of the parasite
15-1-1944 to 29-1-1944	100	24	24	*Azotus delhiensis* Lal
29-1-1944 to 5-2-1944	100	26	26	do
Total	200	50	50	

Average per cent. parasitisation — 25

The table shows that the average percentage of parasitisation for *Azotus delhiensis* is about 25 per cent. The parasitisation is greater in December and January and decreases in February and March when it is practically nil. Laboratory studies have shown that the life-cycle at 58° F. is 13 days on the average. The maximum life-cycle is 16 days and the minimum is 11 days.

The parasite appears in the last week of November in large numbers and oviposits in the first week of December. Oviposition takes place for about 30". The first generation adults liberated on a fresh batch of white-fly pupæ under laboratory conditions approximating to those in the field. They were fed on dilute sugar solution, and after copulation were liberated on white-fly pupæ. The first adult emerged in 3 weeks, the second, third and fourth generations successively in about two weeks. Adults of the fourth generation went into hibernation. In the field there was so much of overspreading and overlapping of generations that it was impossible to determine the number of generations undergone. From the observations it seems that the first generation adults took longer to appear.

Experiments on the longevity of the adult *Azotus delhiensis* were carried out both with food and without food. Under laboratory conditions the average length of the life of the adult female is 3¼ days and that of the male is $2^{3}/_{7}$ days without food; and with food it is $3^{6}/_{7}$ days for the female and $3^{5}/_{7}$ days for the male. The maximum longevity for the males is 4 days and for the females is 5 days and minimum for the former is 1 day and for the female is 2 days without food. The maximum longevity with food for the males is 5 days and that for the females is 6 days. It appears that the females are sturdier than the males and can resist the drought much longer. Record of emergence indicates a proportion of 1 male to 4 females. The parasite emerges through a circular hole cut dorsally in the integument of the host near the anterior end.

The parasite displays super-parasitism, and 3 to 5 pupæ of the parasite have been observed in a single pupa of the white-fly. Each emergent adult parasite cuts a separate circular hole in the dorsum of the white-fly pupa.

The egg, larvæ, pupæ and the adults of the above parasite have been studied and will be described at a later date.

I am very much grateful to Dr. M. A. H. Qadri for his helpful suggestions and his kind interest in my work during my stay at Aligarh. I am grateful to Prof. Karamsingh for his kind encouragement, and to Dr. N. G. Shabde, the Principal, for giving me every facility for work in Mahakoshal Mahavidyalaya, Jubbulpore.

Department of Zoology,
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Jubbulpore, A. M. LALANI.
April 1948.

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ON THE FOOD OF THE 'BEKTI', *LATES CALCARIFER* (BLOCH), IN THE COLD SEASON

MOOKERJEE, Ganguly and Majumdar[1] made a note of the food of 20 specimens of *Lates calcarifer* (Bloch), of about 8·5 inches average length, examined on two days in December 1945. Hardly any additional detailed observation on the food or feeding habits of this brackish-water perch of economic importance is on record. A detailed investigation on the food and feeding habits of this fish which is on hand has brought out the following salient features with reference to the cold season from October 1947 to February 1948.

Systematic analyses of the gut contents of 313 specimens of *L. calcarifer* ranging from 10 inches to 25 inches, collected from the estuarine regions of Bengal and Orissa were carried out. The details of the gut contents and their proportions are given below:—

(1) *Teleosts* (65·34). These consist mainly of Mullets such as *Mugil parsia* and *Mugil* sp; Siluroids such as *Mystus gulio*, and *Mystus* sp.; Clupeid fishes such as *Engraulis grayi*, *E. purava*, *Stolephorus indicus*, *Dorosoma nasus*, *Dorosoma* sp., and *Coilia* sp; *Lates calcarifer*; *Anabas testudineus*; *Sciænoides microdon* (?); *Eleotris fusca* (?) *Datnioides polata*; *Triacanthus* sp.; *Sillago* sp.; *Leiognathus* sp.; *Gerres* sp.; *Barbus* sp.; *Ophicephalus* sp.; *Cynoglossus* sp.; *Hemirhamphus* sp.; gobies, eels and digested remains. (2) *Decapod crustacea*: (*a*) *Anomura* (23·71 per cent.), consisting of *Palæmon carcinus*, *P. idæ* (?), and *Palæmon* sp.; *Penæus indicus*, *P. carinatus*, *P. semisulcatus* and *Penæus* sp.; *Metapenæus monoceros*, *M. brevicornis*, *M. lysianassa*, *M. dobsoni* (?), and *Metapenæus* sp. (*b*) *Brachyura* (2·23 per cent.), comprising of Portunid and Grapsid crabs belonging to the genera *Scylla*, *Charybdis*, *Varuna*, and *Sesarma*.

(3) *Minor crustacea*: (a) *Isopoda* (0·41%), Isopods (parasitic forms) presumably taken in along with the host. (b) *Stomatopoda* (0·4 per cent.), *Squilla* sp. (c) *Miscellaneous crustacean remains* (12·15 per cent.) (4) *Molluscan* shells on coconut tree roots (0·01 per cent.). (5) *Insecta* (0·36 per cent.): Insects, young stages of dragon fly and unidentified insect remains. (6) *Vegetable Matter* (0·64 per cent.) These consist of water weeds, bits of grass, cladodes of casuarina and occasionally leaves of land flora. (7) *Digested Matter* (3·9 per cent.): Animal matter digested and mixed with mucus, and (8) *Mud and Sand Grains* (0·85 per cent.): Fine mud mixed with mucus and particles of sand grains.

In four instances the stomach was found to have been pierced by the pectoral spines of the cat fish *Mystus gulio*.

Seasonal observations are continued with a view to making a detailed, comparative study of the food and feeding habits of the fish in the different seasons and stages of growth.

Observations so far carried out show that *Lates calcarifer* feeds actively in the cold season. It is a column feeder, preying mainly on Teleosteans and Decapod crustaceans. Mud and sand in the guts of a few specimens examined were obviously brought in by the mullets which were consumed. The fragments of vegetable matter included in the diet are probably accidental. The 'Bekti' takes a considerable toll of valuable food fishes, like mullets, clupeids, cat fishes and prawns, but the large variety of specimens consumed show that as long as adequate animal food is provided in the environment, 'Bekti' may not destroy the major food fishes exclusively. By providing sufficient quantities of forage fish it should, therefore, be possible to maintain Bekti farms successfully.

I am grateful to Dr. T. J. Job for his kind guidance and helpful criticism.

Central Inland Fisheries
Research Station, Calcutta, P. M. G. MENON.
March 15, 1948.

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THE ROLE OF *MAWA*, AN INDIGENOUS MILK PRODUCT, IN THE NUTRITION AND EPIDEMIOLOGY

MAWA, a crudely manufactured form of condensed milk, is a widely consumed nutritious diet; although the milk is concentrated enough to facilitate transportation, this product still has enough moisture to favour the growth of micro-organisms of which the moulds give visible growth on its surface within about six days of storage at room temperature. It was of considerable practical interest to determine if mawa plays any part in the dissemination of the intestinal pathogenic bacteria.

The chemical composition of several samples (collected on different occasions) revealed that, on an average, mawa contains 10·81 per cent. moisture, 26·71 per cent. proteins, 29·67 per cent. fat, 19·98 per cent. lactose, 3·81 per cent. ash, 1·46 per cent. calcium, 0·66 per cent. phosphorus and trace of iron. The above composition suggests the possibility of mawa serving as an excellent material for the nutrition of both man and micro-organisms.

Bacteriological studies conducted on mawa with *E. typhosa*, *S. schottmuelleri*, *E. coli communis*, *S. dysenteriæ* (Shiga), *S. paradysenteriæ* (Flexner), and *V. choleriæ* have yielded remarkably clear-cut results on repeated experimentations. Mawa was used in the state obtained and in a slightly more moist state and was experimented upon in both its native (non-sterilized) and steam-sterilized states. Incubation was done both at the room (28°-29° C.) and th ebody (37°C.) temperatures. The results obtained clearly show that growth of all the tested species does take place and that the survival period may vary from 14 to 34 days depending upon the species, the moisture and sterility status of mawa and also on the incubation temperature. A detailed report on this work will be published elsewhere.

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ACCLIMATISATION OF THE MILLIONS *LEBISTES RETICULATUS* (PETERS) IN MADRAS*

IT is widely believed that the Millions, *Lebistes reticulatus* (Peters), are incapable of withstanding the climatic conditions in the hotter tracts of this country.[1] The species is now considered as not being found in India,[2] but only in Ceylon where it is used for larvicidal purposes.[3] It was, however, found thriving in the tanks of the Rameswaram temple situated in Ramnad district in February 1946 during an investigation of the distribution and local densities of the larvicidal fishes indigenous to the provincial waters. It is possible that it has been introduced from Ceylon, but exact details are not available.

In October 1946 a consignment of about 1,000 fish was taken to Madras with a casualty of only 9 *en route*, and stocked in a concrete garden cistern, in which they bred for the first time in December 1946 and several times thereafter. The stock was then distributed to other waters in the City and to departmental farms and certain private waters in the districts of Tanjore, Cuddappah, Kurnool, Malabar and Salem, where they soon got accimatised and multiplied. Through gradual adaptation the fish has also been acclimatised to brackish waters. The maximum size to which the fish has grown is 1·5 inches in the case of the female and 1 inch in the male. The two sexes occur in equal proportions. The females are dull grey in colour; and the males are iridiscent. Details of sexual dimorphism concerning colour, pattern, body form and size, and of the factors influencing sex recognition in the species have already been recorded by Breder and Coates.[4]

Lebistes reticulatus is a surface feeder, and moves about in small groups of 10 to 15. Its food in Madras provincial waters was found to be the following:—

(1) Diatoms and desmids (30 per cent.) *Cosmarium, Closterium, Fragilaria, Melosira, Navicula, Nitzschia, Pinnularia, Suriella,* and *Synedra*). (2) Insect life, including mosquito larvæ (25 per cent.). (3) Crustaceans (20 per cent.) *Copepods, Daphnids* and *Cypris.* (4) Algæ (15 per cent.) (*Anabœna, cladophora, Oscillatoria, Pediastrum* and *Spirogyra.* (5) Rotifers (5 per cent.) Larval forms (3 per cent.). (7) Miscellaneous matter such as sand particles (2 per cent.).

Under artificial conditions it feeds on prawn pulp, oil-cake, mosquito larvæ, cooked rice and egg-yolk.

The breeding habits and development of the species have been detailed by Stoye[5] and Purser.[6] The variations from their observations are indicated below. Maturity is attained when 0·7 inch in size by the male and when 1 inch by the female. The ovarian egg is 1·0 to 1·66 mm. in diameter, whereas the fertilised egg is full of oil-globules and measures 2·0 mm. in diameter. The embryo lies curved over the yolk-sac when 4 mm. in size, showing 8 somites, black eyes and the fin buds. Pigmentation commences when 5 mm. in length, and the mouth cleft appears when 6 mm. in size. The young are released in broods of 5 to 7 at intervals of 3 weeks. At the time of birth the young is 10 mm. long. The yolk-sac is completely absorbed by the third day. Cannibalism is not observed in the Millions; and it lives in harmony with *Gambusia affinis* (B. & G.), *Oryzias melastigma* (McCl.) and *Aplocheilus blochii* (Arnold). While its enemies in its native waters are the fishes, *Crenicichla saxatilis* and *Rivulus harti*, the common frog, *Rana hexadactyla*, is found to feed on it in Madras.

The Millions are successfully used for antimalarial purpose in other parts of the world. In Madras it is observed to be only of moderate utility, the rate of larval consumption being only 20 to 80 per day. The species may, however, become a useful addition to the indigenous larvicides.

I am thankful to Mr. R. S. Venkatraman for technical assistance.

Inland Fisheries Office,
8, Ormes Road, Kilpauk, P. I. CHACKO.
Madras,
March 10, 1948.

* Published with the kind permission of the Director of Industries and Commerce, Madras.

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THE RADII OF SCALES OF *HILSA ILISHA* (HAMILTON) AS AN INDEX OF GROWTH AND AGE*

SEVERAL explanations on the function and significance of the radii of fish scales have been given by various workers including Raj,[1] on the basis of the mode of disposition of the radii. In *Hilsa ilisha* (Hamilton) occurring in the deltaic area of the Godavari, the radii are arranged transversely. A study of these radii of the scales of the pectoral region of 1,110 specimens has revealed that the number of radii represent the body length of the fish in inches.

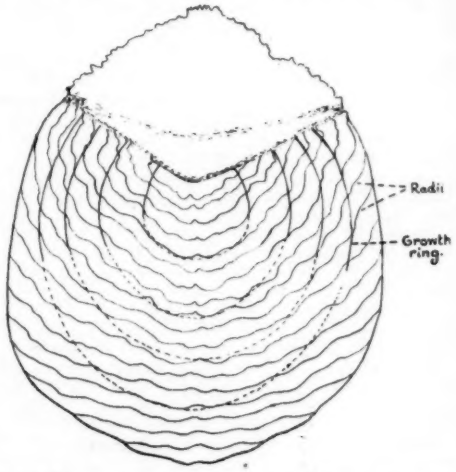

FIG. 1. Diagram of scale of Hilsa, 18·2" in body length

According to Hora[2] and Raj,[3] the maximum length attained by Hilsa during the first year of its life is 9 inches. And according to Job[4] Hilsa grows at the rate of one inch per month and attains a marketable size and about a foot at the end of the first year. Basing on these observations, the age of the fish can also be roughly determined by counting the number of radii.

The following table indicates the relationship between the body length, number of radii and probable age of *Hilsa ilisha*.

No. of specimens examined	Length of body in inches	No. of radii on scale	Probable age in months
87	9·8–10·5	10	10
114	10·7–11·4	11	11
112	11·5–12·4	12	12
121	12·5–13·4	13	13
127	13·5–14·5	14	14
114	14·6–15·5	15	15
98	15·6–16·4	16	16
117	16·5–17·5	17	17
79	17·6–18·4	18	18
88	18·4–19·4	19	19
39	19·5–20·4	20	20
14	20·5–20·8	21	21

It, however, remains to be ascertained if the fish continues to grow in length and to add to the number of the radii until its natural death. The largest Hilsa so far recorded by the authors is a female spawner, 20·8 inches in body length. It is likely that the fish does not escape the fisherman who comb the river

system with destructive gears; and to this extent further investigation is a stalemate.

Inland Fisheries Office, 8, Ormes Road, Kilpauk, Madras, *April* 1948.

P. I. CHACKO.
A. R. K. ZOBAIRI.
B. KRISHNAMURTHI.

* Communicated with the kind permission of the Director of Industries and Commerce, Madras.

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MICROFLORA IN BUTTER

THE importance of micro-organisms, especially moulds of the Penicillium and Odium groups, in fat hydrolysis and development of high acidity in butter leading to the production of a high acid ghee is well known.[1,2] In the course of the studies on the microbiological deterioration of market butter, the authors have observed significant differences between *desi* and creamery butters in regard to the numbers as well as species of microflora present in them. The *desi* butter samples were all reported to be prepared from boiled, soured milk and one to two weeks old, while the creamery butter samples were made from pasteurised cream and 24 to 48 hours old. The average fungal and bacterial counts obtained in different samples of butter are given in Table I. Yeasts and moulds were counted on potato-dextrose agar (Difco). Total and differential counts of bacteria were made on China blue agar and coliforms counted on McConkey's agar. Nile blue sulphate agar was employed for enumerating lipolytic organisms, but the results were not satisfactory.

TABLE I

Counts of fungi and bacteria in butter (log. averages of 10 samples each)

Type of butter	Yeast and mould count per ml.	Bacterial count per ml.			
		Total	Acid producers	Proteolytes	Coniforms
Desi butter	4,915	198,500	31,030	20,180	425
Creamery butter—					
(*a*) Salted	618	1,820,000	515,200	73,500	19,000
(*b*) Unsalted	274	2,071,000	846,500	72,850	48,820

The types of bacteria, yeasts and moulds occurring in the above samples of butter were isolated and classified on the basis of their cultural and biochemical characteristics. Of the bacterial types found in *desi* butter samples, more than 40 per cent. were lactobacilli (mostly resembling either *L. acidophilus* or *L. casei* species), 20 per cent. mere micrococci and the rest included coliforms, aerobic spore-formers (either *B. albolactis* or *B. subtilis*) and streptococci. In creamery butter, coliform organisms (*A. œrogenes* I, Intermediate and an unidentified strain occurring predominantly) constituted more than 50 per cent. of the bacterial flora; 30 per cent. were streptococci (ether *Str. lactic aromaticus* or *Str. paracitrovorous* strains); 10 per cent. were micrococci (mostly *M. caseolyticus* types); and the rest included species of Microbacterium, Achromobacter, Pseudomonas (greenish fluorescence), Serratia (red pigment) and aerobic spore-formers.

The difference in the type and number of organisms between the two butters is mainly due to the acid environment of *desi* butter,[3] which inhibits bacterial growth but favours development of the contaminating yeasts and moulds. For the same reason the highly acid-tolerant lactobacilli, derived from the starters or utensils, form the predominating bacterial types but they are not considered to possess any influence on fat. Except for the lactose-fermenting spore-former (*B. albolactis*) the other species of bacteria are ordinary contaminants having little effect on the spoilage of *desi butter*. The present work, therefore, confirms the previous observations[1,2] that fungi play a major role in the deterioration of *desi* butter. The description of the important types of yeasts and moulds found in butter and their characteristics will be dealt with in a separate note.

The authors are grateful to Dr. Noshir N. Dastur and Dr. K. C. Sen, Director of Dairy Research, for their kind interest in the work.

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H. LAXMINARAYANA.

Indian Dairy Res. Institute, Bangalore, *April* 5, 1948.

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INSTITUTION OF CHEMISTS, INDIA

WHILE highly appreciating the sentiments expressed by Prof. Findlay, it may be pertinent to mention, in this connection, that the Institution of Chemists (India), which was established as early as 1928, has from its very inception been actively engaged in furthering the interests and fostering the healthy development of the profession of Chemistry in this country. It has at present more than 450 members on its rolls, distributed throughout the Indian Union, and has two Branches in the industrial areas of Bihar (Patna) and the United Provinces (Kanpur). The Institution just now has before it a scheme for launching a drive for the further extension of its activities, and its Council is considering a re-orientation of its membership with this object in view.

It may further be mentioned that the Institution has also two organs, a quarterly Journal of its own and another, the Industrial and News Edition, published under the joint auspices of the Institution of Chemists (India), and the Indian Chemical Society.

Chemical Department, Medical College, Calcutta, *May* 15, 1948.

U. P. BASU.

REVIEWS

Darwin's Finches. By David Lack. (Cambridge University Press), 1947. Pp. x + 208. Price 21*sh.* net.

We have read this fascinating and brilliant book with great interest. It is a notable contribution to our knowledge of the limited ornithological fauna of a small group of Passerine birds of the Galapagos, based on an extensive and critical observation of living specimens inhabiting the Archipelago and the kindred stuffed species preserved in the large series of collections at the California Academy of Sciences, the American Museum of Natural History, New York, and at other scientific institutions.

About fourteen small islands comprising the Archipelago, comprehensively known as the Galapagos, received the generic name from the giant land tortoises which provided food for the roving pirates and men engaged in whale fishery. The islands lie on the Equator in the Pacific Ocean about 600 miles from the Equador, and are removed from the nearest islands of Cocos and Malpelo by about the same distance. The Equadorean names of the individual islands first associated with the crew of Columbus were later given the modern English appellations by the patriotic buccaneers of the *Bachelor's Delight*. Regarding the formation of Oceanic Islands, generally there are two rival theories; according to Darwin and his followers they arose from the sea, being elevated above the sea-level by submarine volcanic disturbances and the existing animals on these islands were later introductions; on the other hand the opposite hypothesis postulates that they formed part of the mainland before they were separated from the parent land mass by the deep incursions of the sea, and the island fauna is thus derived from the continent of which the land and animals constituted a part originally.

The title of the book is to be traced to the fact that the whole treatment of the subject-matter refers to the finches which were collected and described by Darwin in 1835 and later further discussed by him in *The Journal* in 1839 on their interrelationship based on the structure of their beaks, abbreviated tails, shape and size of body, plumage and colour variations. Darwin concluded, judging by the relative original paucity of bird-life in the Galapagos and by the perfect gradation in their structural variations, that "one species had been taken and modified for different ends". This important pronouncement on the biological principle of adaptive modification, which has been widely elaborated and applied to other animals since Darwin's observations were made, has formed the study by Mr. Lack, who, while investigating the successive stages in the differentiation of the structural features of the particular group of finches, has extended the application of Darwin's hypothesis to a wider group of organisms living in the Archipelago.

The book is beautifully illustrated. There are 8 coloured plates and 27 text-figures exemplifying extremes of evolutionary changes in the small island group of Passerine birds. The usefulness and value of the book are further enhanced by a comprehensive provision of statistical tables of measurements, an exhaustive list of references and indexes of plants and animals and subject-matter. Students of biology will find in this excellent book sufficient problems for serious scientific study and the general reader will also find great interest in the description of the life-habits of this most fascinating group of birds, treated in a language at once stimulating and attractive.

The expedition to the Galapagos in which the Royal Society and the Zoological Society of London took a keen and practical interest by granting substantial financial assistance, was undertaken before hostilities broke out in Europe, and its results were published on the conclusion of the World War. The book is divided into two parts: the first part is devoted to a description of the islands and the ecological studies of the bird fauna: the second part deals mainly with a more specialised account of the biological theories and problems relating to the origin of Galapagos fauna, the origin and persistence of species and subspecies and adaptive radiation. The Archipelago harbours thirteen species of finches belonging to three genera, *Geospiza, Camarhynchus* and *Certhidea*, while the allied form *Pinaroloxias inornata* occurs in the small island of Cocos which lies beyond the Galapagos belt. The principal interest in the study of this small and self-contained group of bird centres in the fact that it is possible to trace the successive stages in their morphological variations from the most trivial changes to those well-defined divergences which distinguish the species and genera. The main object of the author is an attempt at correlating these striking adaptive gradations to new ways of life and interpreting these phenomena in accordance with the well-known biological hypotheses. The evidence collected and presented in the first part is used in the second for a cautious and clear exposition of more than one chapter in the philosophy of Darwinism.

Apart from the fact that the book has a limited province both in material and problems, it has the rare merit of stimulating the reader to take an intelligent interest in the natural history of birds in his surroundings and the biological factors influencing their life.

C. R. N.

The Dehydration of Food. By T. N. Morris. (Chapman & Hall, Ltd.), 1947. Pp. 174. Price 15*sh.*

The last war gave a fillip to the study of the processes of dehydration of foodstuffs, as dehydrated foods of proper quality were in great demand in almost all theatres of war. The knowledge of dehydration was indeed in a very rudimentary stage before the last war. But as the war continued, systematic researches were instituted on this subject in different

countries and improvement was fairly rapid in the production of high quality dehydrated products.

In the book under review, Mr. T. N. Morris, who is on the staff of the Low Temperature Research Station, Cambridge, has brought together the information gathered mainly by a group of workers of the Ministry of Food and of the Foood Investigation Board of the Department of Scientific and Industrial Research. Researches were mainly carried out at the Low Temperature Research Station, Cambridge, and the Torry Research Station, Aberdeen. In this work the Dunn Nutritional Laboratory, Cambridge, also provided considerable assistance with regard to the nutritive values of dehydrated foodstuffs. The knowledge derived from these planned researches was applied to large-scale practice with the help of some food-manufacturing firms with good results. The collection of all this information in a very handy and readable volume is of special value as with the cessation of war, most of these investigations have been discontinued and scientific interest on this subject has considerably declined. Yet it is generally realised that in case of another war or some other emergency, dehydrated foodstuffs may again be required, and a book of this nature which brings together in one place the latest scientific and technological information on the subject would be particularly valuable as the basis either for immediate application or for further research and development.

The book deals concisely but clearly with the different aspects of the dehydration problem. The value of dehydration in regard to the reduction in volume and weight, thereby saving transport, has been discussed with reference to a large number of foodstuffs like milk, meat, egg, carrot, potato, green vegetables, fish, etc. The nutritive value of the dehydrated foodstuffs compared with that of the fresh samples nas also been referred to. The relative advantages of dehydration, canning and refrigeration, the characteristics of biological materials and the general principles and methods of dehydration are dealt with in three different chapters. There are separate chapters on the following specialised topics :—

(1) Dehydration of vegetables ; (2) dehydration of animal products ; (3) precooked, compounded and compressed dried foods ; (4) the storage of dehydrated foods ; (5) packaging of dehydrated foods ; (6) the examination of dehydrated foods from the physical, chemical, nutritional and organoleptic points of view ; (7) the bacteriological aspects of dehydration ; and (8) the control of insects infesting dehydrated foods.

It will thus be seen that the subject of dehydration has been treated comprehensively, though briefly, in both theoretical and practical aspects. Attention has been drawn to recent work on "freeze-drying" which yields products of a high degree of palatability. But hardly any reference is given to a considerable amount of valuable work which has been carried out in America. The inclusion of such information would have enhanced the value of the book. But the author's object has been mainly to present an account of the work that has been carried out in Great Britain during the war years. Mr. Morris's book is a valuable repository of the knowledge on the subject and would be welcomed by all food-technologists.

B. C. G.

Science News, 4. (Editor John Enogat, Penguin Books, England), 1947. Price 1*sh.*

This number of *Science News* is, like the previous ones, a collection of scientific essays on problems of current interest.

The volume commences with "Life at High Pressures", by Prof. Haldane. This is a description, of characteristic simplicity, of the war work on physiological and psychological reactions of human beings subjected to high pressures. This work was carried out by Prof. Haldane and his co-workers after the Thetis disaster ; and the results were of great value in effecting improvements in the equipment of divers and of submarine crew. Experiments in chambers with oxygen, nitrogen and mixtures of gases at high pressures have revealed an interesting similarity to life in rafied atmospheres, as in aeroplanes and balloons at great altitudes. The curious feature is that oxygen at high pressure is quite as harmful as at low pressure. But, while nitrogen is inoccuous at low pressure, it proves quite toxic at high pressures owing to its rise in concentration in blood.

Other essays like Jet Locomotive, Science and Crime Detection (which is more fascinating than a crime story), Noises from the Sun, Cosmic Rays, and Control of Flowering explain in non-technical language, the recent findings of science and their applications in every-day life. All the matter is so lucidly presented that the intelligent layman is sure to study the book with great interest.

The *Science News* series is truly an attempt to bridge the rapidly widening gap between scientific advance and political backwardness of the human animal. A clear conception of the power for good and evil of science on the part of the democratic citizen and administrator is the surest means of preventing the misuse of science. Publications like the volume under review will go a long way in achieving this object.

K. S. R.

German Research in World War II. By Leslie Simon. (John Wiley & Sons Inc., New York; Chapman & Hall, London.) Pp. 84 + 218. Illustrated by numerous diagrams and photographs. Price $4.00.

Leslie Simon's *German Research in World War II* will appeal mainly to two classes of readers. The young scientist interested in ballistics and aero-dynamical problems will find a good deal of information about the German efforts in these fields. Scientific research, and to some extent, development work must, in the ultimate, remain very much an affair of the individual ; and it is known from experience that too much control or organisation

will quickly lower research output from the brilliant to the mediocre level. Still, organisation and administration there must be—especially when a whole nation is geared to the war effort, and this aspect of research is handled either by a senior scientist or only too often by people without a "research" background. The book is of special interest to senior scientists faced with administrative problems, for Col. Leslie Simon has obviously given much thought not only to the German "set up" but also to the general problem of organising research and development work. The reviewer's advice to busy administrators whose contact with research is incidental is that they should "skip" main part of the book and study with great care the last five pages which contain a summary of conditions which foster research. Apart from these classes of readers there must be quite a number of folk who suffered the unwelcome attentions of some of the German secret weapons and survived. Many of these will no doubt find something of interest in the dispassionate revelations of this volume.

Colonel Leslie Simon's book is largely based on the work of special investigators who followed the advancing armies into Germany, and who endeavoured to collect information and material either of scientific value to the U.S.A. or likely to be useful in fighting Japan. The actual investigatory work was often hampered by the destruction of equipment and records, by the allied attacking troops by the inmates of neighbouring slave-labour camps after release, and sometimes by the Germans themselves.

Further, the German scientific staff had frequently dispersed. These individuals had first to be located and retrieved for questioning. Another difficulty was that the Germans for their own security reasons, did not always disclose the full scope of the problem to individual workers or even the heads of institutions. We are warned by the author against setting too high a value on German achievements since comparative work on the part of the allies must often remain secret.

Surveys are given of the Hermann Goering Air-Force Research establishment near Braunsweig, the Graf Zeppelin Aero-research installation near Stuttgart and the military proving ground at Hillerslehen. In the author's own words, "The research establishments of the German Air Force were the most magnificent, carefully planned and fully equipped that the world has ever seen". The preeminence of the Air-Force research is accounted for partly by the personal influence of Goring and the fact that a competent scientist whose "Nazi" qualifications fell below standard would enjoy a certain measure of protection if employed in an air-force establishment. Army weapon research was, on the other hand, largely stultified or smothered by the powerful armament firms which possessed research and development facilities but which tended to improve existing weapons rather than originate new ones. The general impression is that the German scientists were paid on a scale, not lavish, but sufficient to free them from such financial embarrassments that beset many of the British scientists in the later stages of the war.

Diagrams are given showing the research and development organisations relative to the Air, Sea and Land Forces. These arrangements were apt to be disturbed by strong aggressive personalities, and the army organisation underwent considerable modification when Nazi Government, previously neutral towards research, demanded "miracle" weapons in the later stages of the war. A further comprehensive re-organisation scheme affecting all research establishments was "under way" when Germany collapsed.

In view of the author's experience and qualifications, it is not surprising that as regards the actual experimental work and equipment, he has tended to confine his descriptions to numerous ballistical and aerodynamical problems. These are of specialised interest, and reference will be made only to one or two outstanding features. Wind tunnels operating continuously at supersonic velocities require enormous power. The Germans were able to conduct some successful experiments by utilising the airflow associated with the sudden charging of a huge air reservoir which had previously been gradually evacuated with pumps of moderate power. An interferometer technique was developed for studying air density changes near models undergoing high velocity wind tunnel tests. In their study of blast or shock waves the Germans develop the condenser microphone technique, and little use was made of piezo-electric crystal pick-ups. The shaping of explosive charges in order to obtain directional explosive effects came in for a good deal of attention, and it was discovered that spin-stabilised projectiles were unsuited for cavity charges. Ordinarily, projectiles are either fin or spin stabilised. The Germans found it possible to stabilise high velocity short-range projectiles by means of a deeply grooved nose-piece. Fortunately for the Allies, problems associated with high altitude precision bombing were apparently neglected by the Germans until a very late stage of the war.

The author believes that the outstanding German armament achievement was the development of an effective rocket to be fired from aircraft. Although the Germans undertook considerable research in connection with the turbo-jet propulsion of aircraft the author is of the opinion that precedence must be given to the Americans in the field.

In view of past reputations it seems strange that a valid criticism should be levelled at German instrument design. Yet, for various reasons there was a tendency to perfect existing types of instruments rather than to develop new instruments for novel techniques.

Col. Simon's book not only deals with German war-time research and development but also gives at length the author's views on the general problems of research. Obviously the author has given much thought to these matters and this volume should be consulted by all those who would organise and control a re-

search establishment without destroying the ideals of an enthusiastic research staff.

FRANK ADCOCK.

De Revolutionibus. By Nicolaus Copernicus. Preface and Book 1. Translated by J. F. Dobson and S. Brodetsky. (The Royal Astronomical Society, Burlington House, London, W. 1) Pp. 32. Price 3*sh.* 6*d.*

The birth of modern astronomy dates from the year of publication of the epoch-making book of Nicolaus Copernicus (1473-1543) entitled *De Revolutionibus Orbium Cœlestium* (On the Revolutions of the Spheres of the Universe). For nearly fourteen centuries before Copernicus, the *Almagest* of Ptolemy was the undisputed "scripture of astronomy". The system expounded by Ptolemy regarded the earth as the centre of the Universe around which all the heavenly bodies revolved in circles. To explain the apparent motions of the planets against the background of the fixed stars, Ptolemy devised a system of 'epicycles', each planet moving in a circle while the centre of this circle moved in a bigger circle round the earth. As more and more observational data relating to the motions of the planets accumulated, it became necessary to modify the Ptolemaic system by adding more and more epicycles until the entire picture became very confused and complicated. It was at this stage that Copernicus came forth with his new theory. Copernicus saw that the rotation of the earth from west to east could explain equally well the observed motions of the heavenly bodies as the rotation of all the heavenly bodies in the opposite direction round a fixed earth. Although Ptolemy had rejected such a hypothesis as contrary to commonsense, Copernicus clearly realised its simplicity and emphasised the fact that only relative motion is perceived by the senses. He also recognised that the "Heavens are immeasurable in comparison with the Earth" and, therefore, it was much more probable that the earth, rather than the vast universe, revolved once in 24 hours. He then showed that most of the observed facts of planetary motion could be explained by supposing that all the planets including the Earth revolved round the sun in circular orbits. With certain important modifications at the hands of Kepler, this is still the system which is accepted to-day.

Copernicus foresaw that his theory was bound to meet with violent opposition and refused to publish it for 36 years. At last he yielded to the wishes of his friends and his great book *De Revolutionibus* in which he has set forth his theory at great length was printed in 1543, the year of his death. He did not live to see the printed copy of his book. The book is dedicated to "The Most Holy Lord, Pope Paul III". Copernicus was a mathematician. In the Preface of dedication he has stated that he got his basic ideas from the writings of Greek philosophers belonging to the Pythagorian school and has expressed his conviction that although "idle babblers, ignorant of mathematics" might criticise his work, "gifted and learned mathematicians" are bound to appreciate his theory.

The Royal Astronomical Society has rendered a valuable service in bringing out an English translation of the famous book of Copernicus, thus rendering it accessible to a larger circle of readers. The book should find a place in the library of every scientific institution.

R ANANTHAKRISHNAN.

An Introduction to Vertebrate Anatomy. By H. M. Messer. Second Edition. (MacMillan and Co.), 1947. Pp. 475 + xx. Price 24*sh.*

The revised edition of the *Vertebrate Anatomy*, by Messer, is most welcome since the author has amplified considerably the material of the one-semester course which he projected sometime back and also because certain erroneous concepts in comparative morphology have been clarified.

The book consists of thirteen chapters and each chapter concludes with a summary of the main important points. After a brief introductory chapter dealing with definition of terms, etc., the author gives a clear account of the chordate characters in the next. The protochordates are treated in Chapter III taking Balanoglossus, Ciona and Branchiostoma as types. The author has rightly stressed upon the incorrect homology established between the endostyle of Branchiostoma, the subpharyngeal gland of the larval Petromyzon and the thyroid gland of vertebrates likewise; it is also pointed out that the so-called liver of Branchiostoma, in secreting enzymes, behaves more like a pancreas.

Chapter IV deals with the Vertebrate classification and the characteristics of the groups—the Agnatha comes first and is succeeded by a chapter on Osteichthyes. The figures of Bdellostoma, Petromyzon, Clupea and Squalus could be made more useful if drawn better to show as much of the externals as possible and the parts labelled. Similarly, the figures of Amphibians (pp. 58, 59) are rather crude when compared with those of reptiles and mammals in the following pages. The hares and rabbits are treated separately under a different order, Lagomorpha, from the Rodentia including Sciurus, etc.

Early vertebrate development forms the theme of the next chapter; subjects like maturation, structure of sperm, fertilisation, segmentation, gastrula and the formation of germ layers are clearly described. Terms like cœloblastula and discoblastula are used to describe the Branchiostoma and frog blastula on the one hand and chick blastula on the other.

The integumental structures are described in Chapter VI. The so-called enamel of the clasmobranch placoid scale is shown to be a harder kind of dentine and, therefore, the scale is entirely dermal in origin. An epidermal enamel organ though present does not contribute towards the formation of the scale.

Chapter VII deals with skeleton. While the usual number of cervical vertebræ is seven, exceptions like Manatus (6), Bradypus (9), etc., are noted. The fallacy of the ventral rib (fish) and dorsal rib (most other vertebrates) is pointed out to be no more tenable since these may change their position during development. In the tabular statement (p. 104) of

the chief bones of the skull, the pterotic and sphenotic are classed as dermal bones which is not correct. The term 'alisphenoid' is still retained to describe the pleurosphenoid in the teleostomes. In the figure of Amia (p. 187) the pre- and post-frontals, hyomandibula and quadrate are not delimited. In the figure of *Necturus* (p. 187) the term 'paraquadrate' is used to designate a bone which is now accepted to be squamosal in Amphibia. For the salientian paired "ethmoids' the term sphenethmoid and for the so-called fused frontoparietal, the term 'frontal' is to be preferred.

With regard to the Python skull (p. 189), the demarcations of pre- and post-frontal and post-orbital are not clearly indicated; in the Sphenodon skull (p. 190), similarly the squamosal, quadrate and jugal. In the skull of the bird (Fig. 204) the 'prefrontal' should be read as lacrimal. In the chart on p. 195, giving an idea of the phylogeny of the visceral arches excluding dermal bones in the vertebrate classes, the author tabulates under Osteichthyes, the quadrate and articular; it is not explained why the metapterygoid and antopalatine which are not always dermal bones are omitted; the so-called articular of previous authors is now shown to be as angular. A correct idea of the nature of tails of fiishes is given; the protocercal caudal fin of cyclostome and fish embryos, the heterocercal type of elasmobranch fishes, and the symmetrical diphycercal tail which becomes secondarily so from a heterocercal type is noticed in Crossopterigians and Dipnoi.

The muscles and digestive system are described in Chapters VIII and IX respectively. In the latter chapter, the dental formulæ of some mammals are given and for that of the cow, the incisors and canines are noted as 0/3, 0/0 which should be corrected as 0/4, 0/0.

The respiratory system is described in the next chapter. In the part dealing with the comparative anatomy of the organs, the structure and mechanism of respiration is described in the various classes. In the adult frog, the external nares are described to possess 'valves' closing and opening the orifice; the Fig. 44 (p. 54) shows clearly the premaxillæ as valvular in function, which is correct.

In the chapter on circulatory system, the evolution of the arterial arches is brought out in Figs. 308-310; the usefulness of these figures could be enhanced if the subclavian arteries in crocodile and the mammal are labelled. The arrow heads are missing in Fig. 310*b*.. Since no English text-book on Zoology gives figures of the circulatory system of a turtle, the inclusion of it in the book under review is most welcome.

The excretory and reproductory systems are dealt with in the two succeeding chapters.

In Chapter XIV, the Nervous System is described. Very useful comparative figures of the sagittal sectional views of the vertebrate brain are given. While it is commonly described that there are 8 cranial nerves in Cyclostomes, 10 in an-amniotes and snakes and 12 in amniotes, the anterior sensory nerve called the terminal noticed in all vertebrates (except birds) naturally adds one to the number. The author includes this in the tabular statement on p. 385 and points out that "it is now thought to be associated with the autonomic system" (p. 386).

Sense organs form the theme of Chapter XV, and in the next chapter, the endocrine glands are described. While the function of the cortical portion of the suprarenal is not known, the medulla secretes adrenalin which "produces an increase in the amount of sugar available as an emergency fuel". Secretin, produced by the duodenum governs the secretory activities of liver and pancreas.

The last chapter (XVII) is on the 'Origin and Evolution of Vertebrates'. Discussing this problem, the author points out that "It seems highly probable, therefore, that the chordate highway branched off from the one leading to the higher chordates at an early date in the history of animal life, perhaps as far back as the cœlenterates. The exact ancestors still remain obscure.

There is an useful bibliography, a glossary and an index.

Systematists may not agree with the use of the names, Amphioxus, Triton, Nototrema, Galæopithecus, Echidna and Lepus; and we hope that the errors pointed out will be set right in the next edition.

The get-up of the book is excellent and we have no hesitation in recommending the book to every student of comparative Anatomy.

L. S. R.

Natural Resources and Human Adaptation. By A. M. Lorenzo, Lucknow University. (Universal Publishers Ltd., The Mall, Lucknow), 1947. Pp. 100. Price Rs. 3-12.

Whether or not one feels able to agree with the judgment of Dr. Lorenzo that notwithstanding centuries of "give-and-take" and cultural contact, "the East remains essentially spiritual, the West largely material ..." there can be no doubt that the volume under notice in which he has endeavoured to demonstrate that progress and advancement achieved by different nations of the world are directly dependent on their efficient and successful adaptation to and development of the Natural Resources that act as a challenging stimuli eliciting characteristic reactions, will be welcomed by all students of Geography, Sociology and allied disciplines as calculated to make a real and substantial contribution to the solution of the permanent and persistent problem, difficult and defiant, of definitely observed differences and disparities in the forms and patterns of adjustment and adaptation revealed by the nations of the world to the environment of Natural Resources. There is perhaps a borderland, a No-man's land, encircling with appropriate points of contact, "geography, economics and sociology", and "in this book", the author "has tried to explore this border region to study the physical resources on which the structure of economic life and social institutions rests". Devoting the opening chapter to an analysis of the "Concept of Natural Resources", the author explains that all natural things such as air, water, sunshine, etc., which

lie within reach of man and can be turned to his benefit, belong to the category of "Natural Resources". In the course of the second chapter, a scientific and systematic classification of "Resource-Patterns" is attempted. Examining the foundations of the "Natural Resource potential", the author emphasizes in the third chapter factors, "locational, physiographical, climatic, biological and social". How are these resource-areas constituted? The fourth chapter contains a brief account of the nature and characteristics of the Regions of Bounty, of Increment, of Effort, of Arrested Development, and of Lasting Difficulty. How are these resources to be critically judged and assessed? The conditions of such assessment are elaborated in the fifth. The author has detected something like a hierarchy in the manipulation and control of these resources, marked by three stages, the *etiological*, *ecological*, and *epharmological* to an account of which the sixth chapter is assigned. That economic relationship is governed by the movement of resource-surpluses of one area to another, deficient in such resources, is emphasized in the seventh. On the basis of resources, how is the Economic Strength to be determined? The author concludes in the eighth chapter that the "vegetable civilizations of to-day are economically poorer than the industrial machine civilizations". Modern political geography is shaped and controlled, the author trenchantly observes, by aggressive capitalistic and industrialized nations who, by hook or crook, are bent on acquiring and possessing such areas as contain the Natural Resources necessary for their economic strength and stability. In the tenth chapter, the author indicates the conclusion that stability of civilization and degree of social progress depend not merely on the availability of resource-potential but on such potential being utilized systematically and successfully to the maximum possible advantage.

In view of the importance of the lines of investigation pursued by Dr. Lorenzo, and in view particularly of the specific problems of industrial research and reconstruction that are confronting modern Free India, I have thought it necessary to give the fore-sketched summary of the main elements of value contained in the volume under notice. For centuries past, India has been known as a country devoted to development of spiritual and philosophical culture. It is illlogical and unscientific to believe that Indian culture neglected or condemned material advancement. It is only excessive and exclusive preoccupation with the latter to the utter and complete exclusion of the former that had been denounced by teachers of religion and builders of philosophical systems. Indian culture came into contact with Western, European and American patterns. Reaction must be inevitable. It is, however, a thousand pities that the reaction has not been to the advantage of India.

Dr. Lorenzo points out that only those people and nations that possess resources of workable and unfailing combination of coal and iron would rise to a position of "world-domination, economically, politically and culturally". It will easily be realized that to coal and iron, *Uranium* should now be added on as the final and most decisive resoure-potential. Where objective scientific research is concerned, there is absolutely no use of ethical, moral, and other types of sentimentalism. The truth must be obvious except to those suffering from deep-rooted patterns of perverted cerebration, that, in Hiroshima and Nagasaki, Japan got the only fitting reply to Pearl-Harbour treachery. If, on the contrary, modern America had failed to develop the resource-potential of *Uranium* into concretised Atomic-bombs, and if again, overcome by some type of morbid and abnormal sentimentalism, America had actually thrown open her gates to the invading Japanese, *without any malice at heart* over Pearl-Harbour, World War II would not have come to an end in the present way, and world-history might have had to be re-written.

Be it in Physics or Chemistry, Biology or Psychology, the one central aim should be to transform as much as the Natural-Resources-Potential available into agencies of economic and political power both for resisting the aggressions of unscrupulous invaders and for constructive enhancement of the hedonic hue and tone of life. You cannot have it both ways. Nor would running with the hare and hunting with the hound be possible or profitable. If one has firm and unshakeable faith in the spiritual disciplines of India and the East, he should embark on quest eternal, leaving economics and politics severely alone. If, however, he has firm faith only in laboratory sciences grounded on laboratory verification and qualitatively and quantitatively determined analysis, he must endeavour to harness scientific conclusions and scientific methodology to the task of immediate improvement of the Natural-Resources-Potential available in this country and of enabling the country and people to preserve the freedom and independence from ambitious aggressors and eager exploiters. If spirituality and politics are allowed to coquette with one another, only deep and poignant frustration can result. Such is the much-needed and valuable truth emphasized by Dr. Lorenzo, though he may not strictly be responsible for the conclusions drawn by me and the language and terminology in which they have now been expressed, which are, of course, my own.

The fall of modern Germany and Japan, notwithstanding their perfect control over the scientific and industrial technique of developing the Natural Resources, must make internationalists rub their eyes. There is, however, no need to lapse into fatalistic, philosophical, or spiritualistic speculations. As Dr. Lorenzo points out in his prefatory note, if the world's goods be distributed equitably between the "haves" and the "have-nots", you can build a Paradise on Earth. Science can just study facts as they are and explain natural phenomena as they unfold themselves in the evolutional process. Science can never explain why Nature should be bountiful in certain zones and why so miserly in others. Indian scientists should, therefore, concentrate all their energies on transformation of India's Natural-Resources-Potential into concrete economic bene-

fits and sources of material comfort and happy and healthy living.

I desire to offer only one more comment in conclusion. Dr. Lorenzo says that he is "presenting an *argumentum ad hominem*". In ordinary, common logical parlance, that is the name of a logical *fallacy*, an error in reasoning, based or grounded on appeal to passions, prejudices, personal predilections, etc., and not on appeal to *reason* (i.e., *Argumentum ad judiciam* used by all Science). As a matter of fact, Dr. Lorenzo's treatmnet of the rather complicated subject-matter of political geography or geographical politics is so clearly reasoned and scientific that no one will ever associate it even in the remotest degree with any logical fallacy. The bibliography at the end of the volume makes it a highly useful research-document on which Dr. Lorenzo may sincerely be felicitated.

R. NAGARAJA SARMA.

Note on the Results of Diet Surveys in India. By W. R. Aykroyd. (The Job Press, Cawnpore), 1947. Pp 35. Price Re. 1.

This Special Report No. 16 of the Indian Research Fund Association is a revised and enlarged edition of an earlier Report, No. 3, published in 1939. The need for diet surveys conducted on random groups of population of various economic strata can hardly be overemphasised. While food resources of a country give a rough idea of average food consumption, such averages conceal wide variations in food intake in different areas within the country and in different economic and social groups. On the other hand, actual diet surveys give a truer picture of food consumption, an information which is at once useful both for correcting quantitative and qualitative deficiencies.

In the present publication are included surveys conducted in undivided India, Burma and Ceylon. Out of a total of 153 surveys, 132 relate to India. The surveys cover 4,730 families and about 21,000 individuals. About 75 per cent. of the surveys were made in villages the remainder being carried out in urban and semi-urban localities. A high intake of cereals relative to that of other foods is characteristic of all the groups except a few of higher economic level. The surveys also reveal that, even in normal times, about 30 per cent. of the population does not get enough to eat. Much data of interest to nutrition workers have been obtained as a result of these diet surveys which are neatly summarised in the first few pages. They are, to cite a few: consumption of milk and milk-products tends to be relatively more in the case of wheat-eaters than with rice- or millet-eaters (it should not be understood from this that rice-eaters have an inherent aversion to milk; if they take less milk, it is because of limited supplies only); there is a general all-round improvement in the diet with increase in income, except in the intake of leafy vegetables. The composition of a model balance diet is given as a guide for effecting improvements in diet. Perhaps, progress in this direction is tardy on account of the prevailing food shortage; but this, it is hoped, is only a passing phase.

The Report is very well got-up and should prove immensely useful to those interested in the food problems of India.

S. RANGANATHAN.

United Nations Bulletin of the World Health Orgaisation. Vol. I, No. 1, 1947-48.

This Bulletin has articles on six subjects and is a boquet of mixed flavour. The aim, as stated in the editorial, is "*to assist in developing an informed public opinion among all peoples on matters of health*". This bulletin claims to be the heir of *Bulletin of the League of Nations Health Organisation, etc.* For the present, the bulletin will be published in two languages only—French and English. It will gladden the hearts of all Indians to know that the expert committee on Biological Standardization has Lt.-Col. Sir Sahib Singh Sokhey as a member. Routine standardization, and approval of standards for Heparin, Penicillin, Vitamin E, Oestrus hormones, etc., antitoxins of perfringens, etc., are listed; replacement of standards to suit new environmental conditions have also been ordered. Vaccines for Pertussis, Cholera, Plague (pestis), Smallpox and Yellow-fever cannot be standardised at present, and exchange of relevant strains of bacteria have been recommended. An effort to standardise human anti-A, anti-B, and Rh nomenclature has been indicated, as also the necessity for standardisation of potent penicillins and streptomycins.

The question of therapy and chemoprophylaxis as regards dosage for suppressive and curative treatment of malaria has been modified, because of wider experience on exposure of non-immune subjects to malaria in hyperendemic areas. Causal prophylaxis in doses well below the toxic level which has a total value against *P. falciparun* and a partial one against *P. vivax* is discussed. Contact insecticides like Gammexene and D.D.T. have perhaps reduced the cost of malarial control. But concerted, continuous, persevering action controlled *Anopheles gambiæ* in Brazil and Egypt, even before the days of D.D.T., and one can hope for a greater degree of control by D.D.T. and other potent contact insecticides.

The comparative value of chemotherapeutic drugs, Atebrin, 4 Aminoquinolines SN 6911, SN 7618 (Resochin—SN 7618—is superior to Atebrin and had been patented by the Germans in 1939; it does not discolour the skin). 8 Aminoquinolines, and the biguanides—specially of Paludrine, are discussed.

D.D.T. as a larvacide is expensive and may be almost useless in rainy season and where the mosquitoes breed in non-human habitation regions (spraying has to be done by aeroplane); as a mosquitocide in house-sprayings it is the most useful drug and the budgetary portions of Health of each nation will have to be considered where the purchase of D.D.T. as a recurring annual cost will figure. The reduction of the cost will depend on (1) bionomics of anophelines, (2) methods of application and (3) organisation measures. The last article of the bulletin, "On Malaria Control Campaign in Greece, in 1946", by Dr. M. J. Vine, may be read with the above.

Points made out by him are that D.D.T. for malaria control cannot be used near apiaries or where Bee-keeping has become an industry —the bees die out; nor where Silk-worm rearing is a cottage industry (as in parts of Mysore State—T. Narasipur, Chamarajnagar Taluks). Silk-worm rearing is impossible if D.D.T. is used (one should bear this in mind before purchasing large quantities of D.D.T. for general use by provincial governments). D.D.T. is of great use to kill mosquitoes which are not androphylic but zoophylic and Dr. M. J. Vine grows enthusiastic over its use on this aspect. In the Mysore State it may be necessary to spray D.D.T. by air plane once a month over swamps, channels and lakes, to act as larvicide if the Greek experience is taken as a criterion.

An important note on the immunity reaction, following vaccination against smallpox and post-vaccinal encephalitis is appended. Allergic, reactions are noted. Marsden's and Craigies' statements are well worth repetition. "Immune reaction is only sensitisation." "Elementary bodies of vaccinia, washed and killed by formalin, elicit an early reaction on individuals previously vaccinated." "Sensitivity and immunity to vaccine virus are not necessarily related except in so far as they have a common origin in a previous vaccination."

During the intensive campaign of vaccination in 1939-40 in the Myscre State, the reviewer had noticed extreme redness and regular allergic reactions starting within a few hours to 24 hours of vaccination and continuing for over seven days. Quite a few cases of staphylococcal infections were noticed. It was suggested that buffalo proteins (buffalo calves are used for preparing anti-smallpox vaccine) were the sensitising agents and staphylococcal infection played a secondary role in the cause of illness after vaccination. But the authorities would not accept this simple explanation and it does cheer one to find the same type of explanation offered by the eminent scientists of the World Health Organisation.

Cases of post-vaccinal encephalitis have never been reported in India. In syphilis, India has escaped, rather narrowly (fewer cases of nervous affection as G.P.I., etc., occur in India, due perhaps to the spirochetal toxin spreading itself on the skin (nerve and skin start from the ectoderm and the poison spreads itself on the skin—is it dermotropism?) than on nerve tissues. In the same way, is it possible that post-vaccinal encephalitis, so much dreaded in countries like Holland, Great Britain, etc., does not occur as the poison spreads itself in the skin only in India. It may also be that the disease is not recognised, but this is hardly possible when we have so many brilliant medical men among us. Post-vaccinal encephalitis is discussed by five authors very learnedly; but so far as can be seen, they have arrived at no definite conclusion.

Rat infestation by fumigation on ships and methods of estimating rat population, the decision for the necessity for fumigation are discussed by Dr. M. T. Morgan.

Relapsing fever epidemics in North Africa is the subject-matter of two papers by Drs. Gaud and Morgan. Fortunately the disease which had appeared in S. India in an epidemic form in 1925 (in Nilgiris), died out rapidly—but the menace cannot be said to have been eradicated for ever. The epidemiological aspect is discussed in an instructive way.

A very long article on Tuberculosis in Greece, by Dr. McDougall, is the penultimate article. This article hurts a sensitive Indian mind. UNRRA has poured men, money and material to Greece purely for political ends. When millions died in Bengal of starvation, UNRRA did not offer any help. "Blood is thicker than water", and "East is East and West is West" are trite sayings, but how true these sayings appear when one sees the amount of help given to a small country like Greece, and when none was given to India when her soldiers fought on all battle-fronts to guard the "Churchillian four Freedoms"!

The article reports on the difficulties met with, and how they were overcome by persistence. How different are conditions here!

The Bulletin is a welcome addition to the literature of Preventive Medicine, and should be perused by people who are interested in this aspect of medicine. Future copies of the Bulletin will be welcome.

C. V. NATARAJAN.

Physiology of Man in the Desert. By E. F. Adolph and Associates. (Interscience Publishers, Inc., New York; Interscience Publishers Ltd., London), 1947.

This monograph is an excellent contribution to environmental physiology and embodies the results of careful research carried out by the members of the Rochester Desert Unit, organised under a contract between the U.S.A. Office of Scientific Research and Development and the University of Rochester. The book is written in a simple and lucid style and furnishes very valuable information to any one who wishes to know something about life in a desert, and in particular to those engaged in desert warfare. There is also ample material in this report, particularly in Chapters 6 and 10 to 14, useful to the physiologists, pathologists and physicians.

Based on the statistical data obtained and personal observations made during the period of research, the authors have been able to record the following fundamental facts which are of great importance.

Thermal stress in the desert is 2-3 times that in the tropics, owing to a high radiant heat gain from the direct solar rays and high reflectivity of the sand. Under most desert conditions, humidity plays a negligible role while wind velocity plays a more important part. Clothing is very efficient in shielding a man from a considerable fraction of this radiant gain. Although by removal of clothing a man may feel more comfortable, in any circumstance where water shortage is a possibility, the desert traveller should not remove his outer garments particularly when exposed to direct sun's rays.

The daily sweat output of man in the desert is twice that in the tropics, and is estimated

accurately by subtracting urinary output from fluid consumed. In the desert, 90 per cent. of water lost from the body is spent as sweat, and the loss may range up to 11 litres per day. The rate of sweating is nearly proportional to 2/3 power of body-weight, and so heavy men sweat faster. There is no suppression of sweating even if body is depleted of water to the extent of 10 per cent. of the body-weight. A deficit of 5 to 10 per cent. of the body-weight of water may be set right without ill-effects, but a deficit of 20 per cent. would reach an irreversible state. The predominant physiological need of man in the desert is to replace the loss by drinking sufficient quantity of water, well in time before dehydration is extreme. Inadequate supply of water in a desert is a patent error.

The most obvious ways by which man can economise on his need for water in the desert are (1) cease activity, (2) avoid the sun and (3) remain clothed. A man who lacks plenty of water should refrain from taking foods that contain proteins or salts.

Of all signs which may indicate the approach of dehydration exhaustion, a high pulse rate and a high rectal temperature are the most dependable. They are good indicators of the circulatory strain caused by reduction in the circulating volume of blood and the increasing blood viscosity. The lower the pulse rate, the greater is the fitness to perform work in hot atmosphere.

Dehydration exhaustion is closely allied to heat exhaustion but heat stroke which includes signs of disorganised thermo-regulatory ability, is fundamentally different.

Some produce sweat more highly concentrated in chlorides than others. Such persons may show less muscular efficiency and greater exhaustion. Men in the desert are, therefore, encouraged to use salt liberally.

Acclimatisation to heat may enable men to withstand more dehydration but there can be no acclimatisation to dehydration.

The monograph is well illustrated with photographs, graphs, maps, etc., and contains numerous tables recording statistical data of great interest. It will be a valuable addition to any Library, general or scientific.

B. T. KRISHNAN.

Acta Crystallographica. Editor: P. P. Ewald. (Cambridge University Press.) Annual Subscription £2-10.

This is a bi-monthly journal sponsored by the International Union of Crystallography. The publication of the Journal is expected to begin early this year, and is intended to provide a medium for the publication and discussion of original research in crystallography in its broadest sense. It will concern itself with all those physical and chemical properties of matter intimately connected with atomic arrangement. It will, therefore, touch very closely the interests of the chemist, the physicist, the metallurgist, the mineralogist and the biologist.

The advisory board includes eminent crystallographers like Sir William Bragg and Prof. L. Pauling. The early issues will contain original articles by Lonsdale, Jerslev, Winkler and other distinguished workers in the field.

Contributions to the Journal will be accepted in English, French, German and Russian.

Crystallography is a rapidly expanding field of fundamental and applied research which has a large number of workers devoted to its study both in the Eastern and Western hemisphere Contributions from these workers has long since formed a recognised branch of scientific research demanding a periodical publication devoted all to itself. The foundation of the *Acta Crystallographica* fulfils, therefore, a real need, and is sure to give further fillip to studies in crystallography in its various aspects. We wish our new contemporary every success.

Publications Received

India Meteorological Department, Scientific Notes. Vol. IX, No. 109. "Inter-diurnal Variations of Pressure and Temperature in the Upper Atmosphere Over North India," by M. W. Chiplonkar. Published by the Manager of Publications, Delhi, 1947. Price Annas 14 or 1*sh.* 3*d.*

India Meteorological Department, Scientific Notes, Vol. IX, No. 113. "The Fan Type Radio Meteorograph of the India Meteorological Department," by S. P. Venkiteshwaran, R. P. Thatte and A. Keshavamurthy. Published by the Manager of Publications, Delhi, 1948. Price Rs. 1-10 or 2*sh.* 6*d.*

India Meteorological Department, Scientific Notes. Vol. IX, No. 114. "A Low Pressure Portable Hydrogen Generator for Pilot Balloon Observatories," by L. S. Mathur. Published by the Manager of Publications, Delhi, 1947. Price Annas 5 or 6*d.*

Memoirs of the India Meteorological Department, Vol. XXVII, Part IV. "On the Thermal Structure of the Atmosphere Over Agra," by R. Ananthakrishnan. Published by the Manager of Publications, Delhi, 1948. Price Rs. 2 or 3*sh.*

SCIENCE NOTES AND NEWS

S.-E. Asia Science Office

A Science Co-operation Office to serve as an information bureau for the nations of South-East Asia is being established in New Delhi by the U.N.E.S.C.O.

Dr. Alexander Wolsky, Hungarian Zoologist, will be in charge of the office which will serve India, Pakistan, Ceylon, Burma, Malaya, Singapore and Indonesia. An office in Nanking will cater to the interests of the Far Eastern countries.

The organisation will seek to bring scientists of South-East Asia into contact with one another and to make available to them the findings of scientists elsewhere in the world. The office will also serve as a bureau for the exchange of information and publications. Data will be available on scientific apparatus.

The Science Co-operation Office will work through institutes of science, universities and appropriate Government Ministries. The set up will comprehend all branches of Natural Science—physics, chemistry, biology, mathematics, geology, geography, mineralogy and related subjects.

Development of the Forest College at Coimbatore

An expansion of the Forest College at Coimbatore which, at the moment, provides only a Ranger's Training course, is contemplated by the Government of India. So far, Dehra Dun Forest College was the only centre in India, which provided facilities for higher training and research in Forestry. Officers for the Indian Forest Service were recruited from among the students of the Dehra Dun College. According to the present scheme, Coimbatore will have similar facilities and enjoy a higher status. The Institution will cater to the needs of South India and extend its hospitality to students from Ceylon, Malaya and Burma. It is hoped that Coimbatore which has built up a strong tradition for agricultural research and development will develop a strong school of research and tackle problems pertaining to economic products like sandal which constitutes an exclusive forest crop of the Deccan Plateau.

Nuclear Physics at the Calcutta University

Early in 1940, the Dorabji Tata Trust, Bombay, generously donated Rs. 60,000 towards the cost of installing a cyclotron and at the time great hopes were entertained that radio-active isotopes would be made available to biochemists and medical men. For some reason or other these hopes have not yet been realised, and we are happy to learn that there has been revival of the proposal which, this time, appears to be taking a more practical shape.

The progressive Government of West Bengal have sanctioned a grant of 2 lakhs of rupees for an Institute dedicated to fundamental research in nuclear physics under the auspices of the University of Calcutta. Laying the Foundation Stone of the Institute, Dr. Shyama Prasad Mookherjee declared that India could not remain a mere spectator in the grand drama of human achievement, particularly when she had all the raw materials in plenty for the development of atomic energy. He hoped that within their own life-time, discoveries in this field might influence every phase of human life.

In a project of this kind it is not the funds nor the availability of raw materials which matters, it is the lack of trained personnel with practical knowledge and experience. The most effective way of meeting this deficiency and the one which is usually adopted by all progressive countries, is to invite a few eminent scientists from abroad for initiating and organising these studies. Such men are available and would be willing to accept such responsibilities for a short period. It is, however, a matter of some satisfaction that a good number of Indian scholars are now obtaining the necessary experience in the experimental aspects of nuclear physics, biochemistry and medicine, and it is hoped that these young and enthusiastic workers will constitute a brilliant team and build up a school of nuclear studies in this country.

National Central Library for India

The Government of India have appointed an Expert Committee to consider and report on the advisability of establishing a National Central Library in India. It is proposed that one of the sections of this Library should be a Central Copyright Library to which a copy of all publications published in India will be sent.

Dr. Tara Chand, the Educational Adviser to the Government of India, is the Chairman of the Committee, and Mr. B. S. Kesavan, Librarian, Imperial Library, Calcutta, is the Secretary of the Committee.

The terms of reference of the Expert Committee are to consider and report on (*a*) the scope of legislation, if any, for establishing a National Central Library; (*b*) the functions of the Library; (*c*) the administration and staff, building, etc., needed; (*d*) finances; and (*e*) the relation of the National Central Library with (i) the Imperial Library, Calcutta, (ii) the Central Secretariat Library and other Central Government Libraries, and (iii) Provincial Libraries.

The Committee held its first meeting in Delhi in the first week of April.

Drug Museum for India

A number of crude drugs of vegetable origin as well as a number of fixed and essential oils have been collected for the work of the

Indian Pharmacopœial List Committee of the Government of India. This collection with proper labelling and the herbarium sheets of most of them has been sent to the Director-General, Indian Medical Service, by Mr. S. N. Bal, a member of the Committee, to form the nucleus of a drug museum, according to the report of the Botanical Survey of India, for 1945-46.

Though the gallery of the Industrial Section of the Indian Museum, Calcutta, was closed to the public during this period, the Department continued to supply information regarding the botanical products of India to Military and Civil Hospitals, Medical Institutions and Industrial concerns.

The Botanical Society of Bengal, Calcutta

The Annual Report for 1947-48 records the activities of the Society during the year which includes the presentation of seven original papers and the holding of a special symposium on the "Scope of Cultivation of Indigenous Medicinal Plants in India". The Society issued its first bulletin in April 1947 but due to "financial limitations", the second issue could not appear. We are afraid that the multiplication of journals in India in the present stage of our science, is undesirable; it is far wiser to make use of the existing journals, and extend our support to them. Individual societies can always obtain reprints of their contributions for distribution among their members. This procedure, if adopted, would prove economical and serve to consolidate the position of existing scientific journals in India.

Zoological Society of India

The following Members of the Executive Council were elected at the annual meeting held at Patna in January 1948:—*President*: Dr. S. L. Hora; *Vice-President*: Prof. D. R. Bhattacharya; *Secretary*: Hon. Major Dr. M. L. Roonwal; *Editor*: Prof. K. N. Bahl; *Treasurer*: Dr. B. S. Chauhan; *Members*: Dr. N. K. Panikkar, Prof. M. A. Moghe, Dr. B. N. Chopra, Dr. Bhattacharya, Dr. G. D. Bhalerao, Dr. D. V. Bal, Dr. T. J. Job. It is intended to bring out the first volume of the *Journal of the Zoological Society of India* this year. Papers intended for publication, which should either be original contributions or critical reviews of current researches, not published elsewhere, should be sent either to the Editor (at the Zoology Department, Lucknow University, Lucknow) or to the Secretary (at the Zoological Survey of India, Benares Cantt.). Persons intending to become members should contact the Secretary.

International Congress of Food and Agricultural Industries

The Seventh International Congress of Food and Agricultural Industries will meet in Paris between the 12th and the 18th July 1948, at the invitation of the French Government.

Monsieur André Mayer, Professor at the College de France, who is Chairman of the Executive Committee of the U.N.O. for Nutrition and Agriculture, will speak on "The Importance of Technical Developments in the Agricultural Industries in the Fight against Malnutrition". Monsieur Bossaert will deal with the problem of stabilising world prices of agricultural raw products.

The Congress will comprise more than thirty sections, dealing with problems of special urgency at the present time. Further details may be had from the Commission Internationale des Industries Agricoles, 18, Avenue de Villars, Paris; 51, Route de Frontenex, Geneva.

Standardisation of Textiles

A delegation of Indian experts, led by Dr. L. C. Verman, it is understood, will be shortly attending a meeting of the International Committee on Textiles, which is an auxiliary body of the International Organisation for Standardisation (I.S.O.). The meeting of the Committee will be held at Buxton (U.K.) on June 14, a day prior to which the Indian Delegation will participate in the Annual Convention of the British Textile Institute. Dr. Verman is also expected to extend his tour to the U.S.A., and Canada with a view to studying at first hand the standardisation activities of the National Standards Bodies of these countries.

Aerosporin for Whooping Cough

Recent work on Aerosporin, isolated from bacillus aerosporus, has shown that this antibiotic is more potent against whooping-cough than streptomycin and sulphonamides. The clinical dosage of Aerosporin has no apparent toxic effects, and the bacteria develop very little resistance to the antibiotic. This is a great advantage not possessed by most other antibiotics. The drug is being now manufactured in Britain.

Dr. S. R. Ranganathan

The British Council has invited Dr. S. R. Ranganathan to visit the United Kingdom as its guest for two or three months this year. Dr. Ranganathan, who will be leaving India at about the end of May, will also visit France and the Netherlands.

While in England, Dr. Ranganathan will visit the most important British libraries and will study the National and County Central Library schemes in operation. He will also teach at the UNESCO Library Summer School, to be held in Manchester in September.

Editor: M. Sreenivasaya, B.A., F.I.I.Sc., F.A.Sc.
472-18 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for The Current Science Association, Bangalore

INDIAN RESEARCH FUND ASSOCIATION

Applications are invited for the following posts on I.R.F.A. neuropathological unit to be based at the Tata Memorial Hospital, Bombay.

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All applications should be made on the prescribed forms which can be obtained from the office of the Secretary, Indian Research Fund Association, Hutments Civil Block No. 36 Behind South Block, Central Secretariat, New Delhi. Completed application forms should be submitted so as to reach Dr. V. R. Khanolkar, Director of Laboratories, Tata Memorial Hospital, Parel, Bombay, not later than the **15th June, 1948.**

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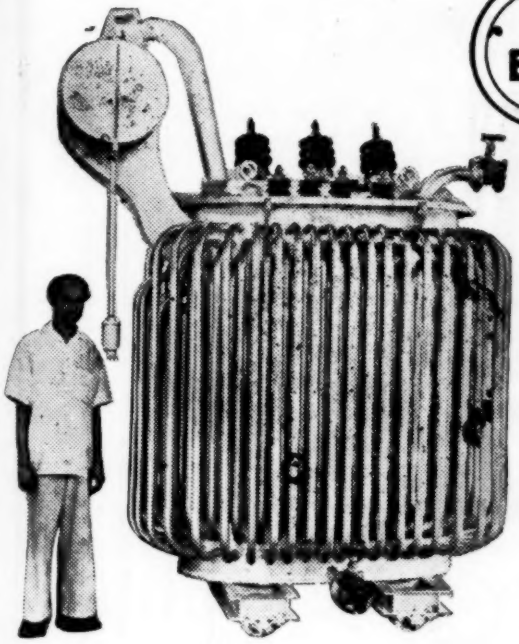

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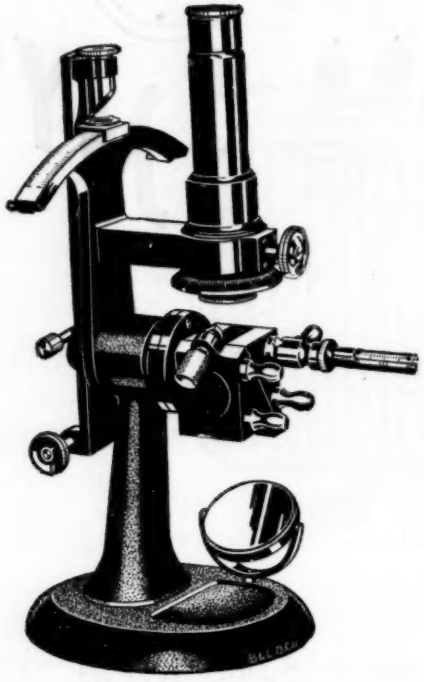

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